

FUNDAMENTALS OF EDUCATIONAL PSYCHOLOGY

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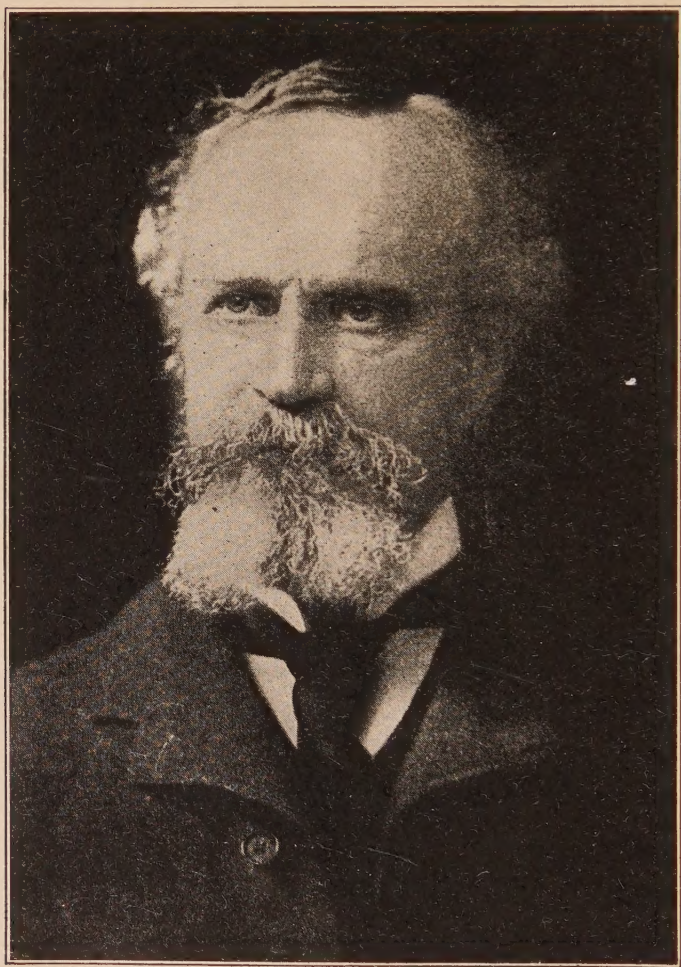
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William James

FUNDAMENTALS OF EDUCATIONAL PSYCHOLOGY

BY

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RESPECTFULLY DEDICATED

TO

E. GEORGE PAYNE

ASSISTANT DEAN, AND PROFESSOR OF EDUCATIONAL SOCIOLOGY

SCHOOL OF EDUCATION

NEW YORK UNIVERSITY

AND

PAUL R. RADOSAVLJEVICH

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NEW YORK UNIVERSITY

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PREFACE

THE authors, having used various textbooks in the field of educational psychology with hundreds of students, feel very keenly the need for a text in which the following conditions obtain:

1. More detailed treatment of the major psychological problems as related to classroom practice than that found in the average text.

2. Greater emphasis upon significant contributions of the many psychologists regardless of viewpoint, and less emphasis upon particular viewpoints.

3. More attention given to the social and applied aspects of the subject, and less to material that is impractical and irrelevant.

4. A text written for teachers in service, and for students of education and social and religious work, which will help them in attacking their problems more intelligently.

5. A frank expression of sane opinion concerning certain topics that have been misinterpreted or overemphasized in certain quarters during the recent years, e.g. intelligence tests, the significance of test results, new-type classroom tests, endocrinology, heredity, and behavioristic psychology.

In this text the authors have attempted to conform to these standards. How well they may have succeeded remains for others to judge.

No attempt has been made to present a logical system of educational psychology. This has been done most admirably by E. L. Thorndike, R. M. Ogden, A. I. Gates, C. H. Judd, H. L. Hollingworth, and others. Limited space makes impossible any statement of the psychology of school subjects.

Much has been borrowed, although unconsciously in many instances, from many of the great writers in this field, including William James, John Dewey, G. Stanley Hall, Edward Lee Thorndike, Charles H. Judd, J. R. Angell, F. N. Freeman, W. B. Pillsbury, H. H. Horne, A. I. Gates, and W. C. Bagley. The authors are more particularly indebted to many of their teachers of psychology and educational psychology, including the following: Oscar Chrisman, Willis Gard, B. R. Buckingham, A. I. Gates, Margaret Noonan, James E. Lough, John W. Withers, C. E. Benson, P. V. West, E. L. Thorndike, and Paul R. Radosavljevich. To Charles E. Skinner, Associate Professor of Educational Psychology, New York University, the authors are specifically indebted for having offered many constructive criticisms.

I. M. G.

H. C. S.



John W. Withers

INTRODUCTION

To an understanding of mental growth and development, educational psychology is a chief contributor. Educational psychology shares, however, with educational sociology in providing the basic foundation for understanding all human activities. The science and art of teaching is built upon these two basic sciences. In this volume, we are concerned with the subject matter, methods, and applications of educational psychology.

A knowledge of educational psychology is valuable to the extent that it increases efficiency in learning and teaching. The child possesses at birth potential capacities and abilities that develop with use. Every experience influences him for better or worse. Every experience leaves its deposit. The deposits or modifications, in turn, become a part of all subsequent situations, which give rise to other responses or activities. In the process

of learning, it is obvious that there is considerable waste which can be minimized if the learner and the teacher understand the difficulties and hindrances to learning. The teacher must locate these difficulties and devise ways and means of avoiding them. Every pupil has a fund of experience and native equipment of wants, cravings, urges, and aptitudes. The teacher must learn how this unlearned capital can be built upon.

Psychology Defined. Psychology is the science of behavior, including all sorts of responses and inhibitions of the organism to situations that arise. These reactions or responses may be muscular, glandular, conscious, or unconscious. Psychology is the science of thinking, feeling, and acting. Data of consciousness are just as much its subject matter as are the more objectively observable facts of muscular and glandular reactions. Psychology thus attempts to gather, organize, and interpret the facts of human experience.

The Meaning of Educational Psychology. Educational psychology is concerned with the findings of psychology to the extent that they add to our fund of knowledge concerning the growth and development of the human mind on the different mental levels. The science of educational psychology has for its proper study such aspects of behavior as: the unlearned equipment of man, the learning process, the special modes of learning, appreciating, and applying subject matter. Educational psychology seeks to gather, analyze, classify, describe, interpret, and evaluate facts and principles of human behavior so that they may be utilized in the learning and teaching processes.

Sources of Data. The chief sources of facts in educational psychology are: (1) the experimental studies of human behavior in the classroom or laboratory; (2) classroom studies involving the use of tests and measurements; and (3) relevant results of the related sciences — educational sociology, educational biology, general and applied psychology, social psychology, genetic psychology, animal psychology, abnormal psychology, clinical psychology, psychiatry, and psychoanalysis.

BIBLIOGRAPHY

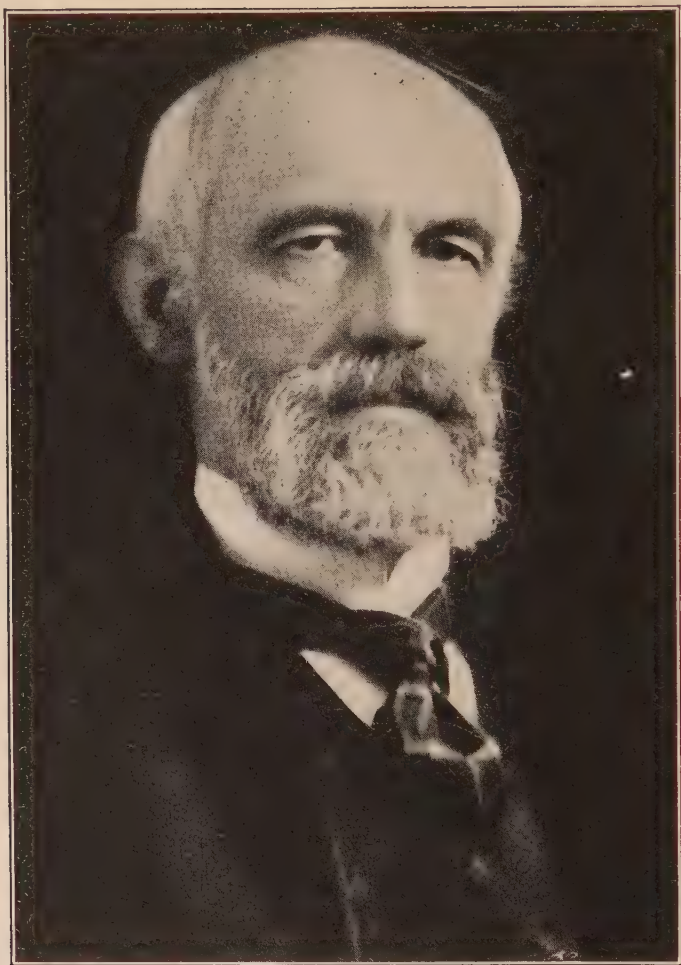
CURRENT thought in educational psychology and educational practices has resulted very largely from the teachings and writings of a group of great psychologists and educational psychologists. Aristotle, John Locke, Rousseau, Herbart, Froebel, and Preyer left their impress. Sully, Bain, and Stout added their contributions. Educational psychology is indebted indirectly most of all to the great psychologists, Wilhelm Wundt, James Ward, and William James. Wundt trained a great number of American Psychologists. Among these are Titchener, Judd, G. Stanley Hall, McKeen Cattell, Muensterberg, Witmer, Angell, Arps, Ladd, Scripture, Stratton, and Pintner. The Wundtian psychology extends through these men to their pupils. Among Titchener's pupils are: Bagley, Whipple, Ogden, Baird, Bentley, Boring, Washburn, Pillsbury, Weld, Foster, Gamble, Pyle, and Dallenback. Among G. Stanley Hall's pupils are: Terman, Goddard, Kuhlmann, Kirkpatrick, Gesell, Wallin, Huey, Bolton, Jastrow, Sandford, Dewey, Book, Colvin, Leuba, Starbuck, Weld, and Wells. Through McKeen Cattell we have Henmon, Lyman Wells, Woodworth, Hollingworth, Thorndike, Dearborn, Betts, Sandiford, and Strayer. Through Ladd we have Buchner, Freeman, Seashore, Withers, Link, and Cameron. From James we have Thorndike, Angell, Harris, Dewey, Jastrow, Marshall, Hanus, Calkins, Dunlap, Lough, MacDougall, Yerkes, Holt, Pratt, Sidis, and B. T. Baldwin. Each of these groups has its offspring. Angell trained such prominent men as Carr, Watson, Fernald, Peterson, Kitson, Kantor, Gray, Thurstone, Robinson, Webb, Gilliland, Bingham, King, Charters, Downey, Miner, and Faris.

Undoubtedly educational psychology has been influenced most directly of all by Thorndike, Meumann, Judd, G. Stanley Hall, and John Dewey. Many other valuable contributions have been made by Gates, Freeman, Terman, Wallin, Drever, Winch, Stern, Binet, Rusk, and Sandiford.

The following books are recommended to all students of educational psychology. The titles that are starred are classical contributions to the literature of this science. All of the references contain suitable material which can be used to supplement the work of this text.

1. AVERILL, Educational Psychology
- * 2. BAGLEY, Educational Determinism
3. BALDWIN and STECHER, Psychology of the Pre-School Child
4. BENSON ET AL., Psychology for Teachers
5. BOLTON, Everyday Psychology for Teachers
6. BUCKINGHAM, Research for Teachers
- * 7. BURNHAM, The Normal Mind
8. CAMERON, Educational Psychology
- * 9. COLVIN, The Learning Process
10. DEARBORN, Intelligence Tests
- * 11. DEWEY, Human Nature and Conduct; How We Think
12. DREVER, Introduction to the Psychology of Education
13. FOX, Educational Psychology
- * 14. FREEMAN, How Children Learn
15. GATES, Psychology for Students of Education
16. GESELL, The Mental Growth of the Pre-School Child
- * 17. HALL, Adolescence (2 volumes) and Senescence
18. HOLLINGWORTH, Mental Growth and Decline
19. HORNE, Psychological Principles of Education
- * 20. JAMES, Talks to Teachers on Psychology
21. JORDAN, Educational Psychology
- * 22. JUDD, Psychology of Social Institutions; Psychology of Secondary Education
- * 23. KOFFKA, Growth of the Mind

24. LA RUE, Psychology for Teachers
- * 25. MUENSTERBERG, Psychology and the Teacher
26. NORSWORTHY and WHITLEY, Psychology of Childhood
27. OGDEN, Psychology and Education
28. PECHSTEIN and MCGREGOR, Psychology of the Junior High School Child
29. PILLSBURY, Education as the Psychologist Sees It
30. PYLE, Educational Psychology ; Psychology of Learning
31. REED, Psychology of the Elementary School Subjects
32. RUSK, Experimental Education
33. SANDIFORD, The Mental and Physical Life of School Children
34. SKINNER, GAST, and SKINNER, Readings in Educational Psychology
35. SPENCE and WATSON, Sketches In and Out of School
36. STARCH, Educational Psychology
37. STRONG, Psychology for Teachers
38. Terman, Measurement of Intelligence ; Intelligence of School Children
- * 39. THORNDIKE, Educational Psychology (3 volumes)
- * 40. WALLIN, Clinical and Abnormal Psychology ; Education of Handicapped Children
- * 41. WARD, Psychology Applied to Education
42. WELTON, Psychology of Education
- * 43. WHIPPLE, Manual of Mental and Physical Tests
- * 44. THE CHILD : HIS NATURE AND HIS NEEDS (Edited by M. V. O'Shea)



G. Stanley Hall

FUNDAMENTALS OF EDUCATIONAL PSYCHOLOGY

CHAPTER I

ORIGINAL NATURE

HUMAN behavior is the result of a number of forces. Many authorities speak of these forces as heredity¹ and environment. Since environment is a very general term, it is advisable to analyze the term into its several components. Environment includes social heredity, physical environment, training, and education. It is obvious that heredity and environment do not operate independently. The child at birth is a product of both forces. There can be no biological heredity operative in any individual's life without environment; and environment cannot operate independent of biological heredity. In addition to these forces, some authorities add the "will," which denotes the active life impulse in each individual.

Original nature refers to the equipment or bodily structure and functions that are either operative at birth or which become operative later largely independent of training and educational influences. The original nature of an individual is a product of his biological inheritance, prenatal environment, and maturation. The native or unlearned equipment consists of a highly complex and integrated structure which begins to function early in the embryonic life. At birth the organism functions on a still higher level. In addition to the activities present, the child has potentialities which will develop in the course of time if the right environment is provided. Native equipment includes on

¹Heredity includes remote ancestry, near ancestry, race, and sex.

the functional side physiological actions, reflexes, instinct tendencies, innate tendencies to awareness or consciousness; tendencies to attend, to remember, to imagine, to strive, to experience feelings and emotions; and innate capacities to learn or form habits of both a general and a special nature. The general capacity is known as intelligence. In addition to this general capacity there are special abilities, talents, aptitudes, and disabilities. All of these functions exist because of the body structure and its organization. The items included in man's original nature will be discussed in subsequent chapters. In this chapter we shall discuss some of the more relevant native tendencies and activities, and some of the ways of modifying such adjustments or actions in the individual.

The adaptation of the organism to its environment is the function of the elaborate and finely integrated nervous system. This is true of the most primitive nerve structures in the lower organisms, and also in case of the complex human nerve structures. Mental processes or functions of body structure aim to stimulate and control action in accordance with the organism's needs. Sensations, images, feelings, strivings, judgments, and acts of memory exist not for their own sake, but for the purpose of adjustment or action.

The responses, whether caused by inner or outer forces, vary in complexity. The actions of animals with simple nervous systems are very different from those of the higher animals. The adjustments of the babe cannot compare in complexity with those of the adult. The behavior of the educated man is much different from that of the uneducated man. If we seek the explanation of these differences, we shall find it in the degree of elaborateness of the neurone pattern, as determined by heredity, maturity, and experience.

The following list of unlearned and learned actions is indicative of the great variety to be found in everyday life:

1. Physiological action, such as the beating of the heart, breathing, peristalsis, and digestion. (Unlearned)

2. Reflex action, such as the contraction of the pupil of the eye when it is stimulated by light. (Unlearned)
3. Impulsive and instinctive actions. (Unlearned)
4. Habitual action. (Learned)
5. Volitional action. (Learned)

Actions and action tendencies have been classified in various ways. In addition to the types listed above, some writers recognize as separate types random and spontaneous movement, sensorimotor action, ideomotor action, automatic action, imitative action, and unconscious (or subconscious) action. At present we are primarily concerned with physiological, reflex, impulsive, and instinctive behavior and the ways of modifying unlearned reactions. Some of these types are not mutually exclusive. Physiological, reflex, impulsive, and instinctive behavior may be treated as differentiated forms of native tendencies. Habit and volitional activities may be regarded as acquisitions or modifications of unlearned reactions.

Tropisms. Whenever an organism is stimulated there is reaction or response of some kind. That is to say, the organism possesses the characteristic known as sensitivity or irritability. Responses or reactions, whatever their character, are termed behavior. The simplest form of behavior, genetically speaking, is the chemophysical response to some stimulus. This is called a *tropism*, meaning that the response is of such nature that the organism turns or moves toward or away from the stimulus. Davenport through extensive experiments found that the stimuli that produce such responses "may be grouped into eight categories, determined largely by convenience: namely, (1) chemical substances; (2) water; (3) density of medium; (4) molar agents; (5) gravity; (6) electricity; (7) light; and (8) heat." Thus, depending upon the nature of the stimulus, we have *chemotropism* — orientation with respect to chemical stimulation; *heliotropism* — orientation with respect to the light or sun; *geotropism* — orientation with respect to the earth; *thermotropism* — reaction to differences in heat intensity, etc.

The simpler responses of the higher organisms differ from the tropic responses of the lower forms of life, in the greater specialization of structure and function in the former. In the tropisms there is no evidence of specialized function, or of nerve tissue. The tropic response is just a simple, direct, and inevitable reaction due to chemical sensitivity.

Physiological Actions. In human beings, and in animals generally, certain internal processes, like breathing, blood circulation, digestion, and secretion are going on, over which the brain exercises no control and which are in operation from the earliest days of life. These are called *automatic* or *physiological actions*, or *organic reflexes*. Such acts result from internal stimuli rather than from chemical forces from without. Their chief function is to preserve the physiologic processes upon which life and health depend. They represent a response of higher order than the tropism and are dependent upon relatively complex nervous structure for their operation.

These actions are so indispensable to life and so automatic in character that it is best, if not absolutely essential to the welfare of the organism, that they be allowed to function without conscious interference.

Reflexes. The first spontaneous and random actions of the human being take place at about the middle of the prenatal period. These simple movements, which are of a purposive character, are the forerunners of a great variety of actions which manifest themselves at or shortly after birth, such as crying, sneezing, smiling, coughing, hiccoughing, grasping, sucking, co-ordination of eyes; movements of fingers, hands, arms, toes, feet, and legs; the turning of the head, crawling, standing, walking, and vocalization.

These simple responses are useful from the first and uniform throughout normal life. Some of these simple responses, like the contraction of the pupil of the eye from light, and the knee jerk, aid in diagnosing certain nervous and mental disorders.

Actions, called reflexes, involve both the nerve centers in the

spinal cord and the brain, and are known as spinal and cerebral reflexes respectively. Reflexes are practically free and independent of conscious control.

The simplest possible hypothetical "reflex arc" involves at least two neurones, a sensory (afferent) neurone and a motor (efferent) neurone. Probably no such simple arc exists. Instead, the simplest arcs undoubtedly involve hundreds if not thousands of neurones. The general rule seems to be that one afferent neurone makes connections with a number of efferent elements, for example, the wink caused by the contact of some minute foreign substance with the surface of the eye. The area stimulated may be so small that we would think of not more than one sensory nerve being concerned. Yet to produce the muscular response, a very large number of fibres must carry impulses to the muscles involved. The neurologists believe that the spread of the process is accomplished largely through the intermediary of the connecting or association neurones between those which are afferent and those which are efferent. These association neurones are often called adjusters. It is obvious that such arrangement is very economical, particularly when we consider that adjusters of a lower order are doubtless dominated by those of a higher order.

Reflexes Defined. An action is spoken of as a *reflex* when a stimulus arouses a relatively simple type of neuromuscular or neuroglandular pattern and leads directly to a simple, complete, and final response without delay or interruption. A simple reflex, as implied above, is probably a purely abstract conception. A reflex mechanism is a predetermined or inherited neuromuscular or neuroglandular pattern which operates when its adequate stimulus is presented. The reflex appears to be due to an inherited structural and functional prearrangement for behavior, inborn neural connections of particular nerve cells, and muscle or gland cells, of such a nature that when the stimulus is applied, action follows. The older physiologists limited their description of reflex actions to reflex movements, but we

now recognize that the reflex act may affect not only the muscles — voluntary, involuntary, and cardiac — but also the glands. There are reflex secretions as well as reflex movements. Some of the reflexes are very simple, involving a single muscle, while others are highly complex and coördinated so as to produce an orderly and useful movement. Still others are convulsive in character, lack coördination, and consequently result in disorderly and useless movements. Reflexes may be described as follows:

1. Reflexes are unitary responses, not of the entire organism, but of a mechanism possessed by an organism. They are a function of the entire behavior equipment and the specific situation present.

2. They are localized in and dependent upon the integrity of sense organs, the organs of response, and the connecting and adjusting system. If all these elements are intact, the reaction takes place mechanically and without delay after the stimulus is given. The reaction is extraordinarily uniform and constant, in the sense that it can be depended upon, so long as the organism is in normal condition.

3. They are not dependent upon consciousness, either for their initiation or their control; nor are they dependent for their initiation on the "will" or purpose of the individual.

4. They are inherited reactions otherwise classified as unlearned permanent factors in the reaction equipment of the individual. A reflex has only one action system. Simple reflexes always remain simple and do not become integrated into more complex reaction systems.

5. They are of greatest utility to the organism, consisting as they do of protective, defensive, or adjustive movements.

Reflex behavior is related to and dependent upon the biological structure of the organism. Consequently it is a life-maintaining activity, operating from the very inception of the organism's life. Reflexes are so intimately related to the total behavior that they constitute a source of stimuli to many reac-

tions. They probably account for much of our action and many of our feelings, moods, states of readiness, and mind sets. Among psychologists, there is a growing conviction that reflexes play a larger part in our total adjustments than was ever before realized.

During the first few months of life, reflexes are of especial importance. The baby grasps, reaches, rolls, crawls, and makes defensive movements reflexly. Out of these reflexes, some of which seem to be random movements, the infant builds the coordinated acts which he is constantly learning. The ability of the child to pick up an object at which he is looking (the eye-hand coördination) is developed out of the reflexes of reaching and grasping — reflexes which are later so overlaid with habit that they eventually disappear. We may well regard most reflexes as purposeful in the sense that they contribute to the well-being of the individual.

For practical purposes, reflexes have been classified into the following types:

Reflexes that are adjustments (1) to conditions within the organism, (2) to changes surrounding the individual, and (3) to both of these at once. The first class (introceptive) includes the responses of the stomach and intestinal reflexes, etc. The second class (extroceptive) includes reflexes of the hand, foot, or body, the knee jerk, turning the head to a sound or to light, writhing, trembling, and shivering. The third class of reflexes which adapts the individual to both internal and external stimuli, includes sexual and salivary responses, and the startling responses.

Impulsive Action. Impulsive action arises from internal stimuli that characterize feeling and emotion. The impulsive act is dominated by a strong feeling rather than by reason. Consequently it has less stability than the reflex. It has been regarded as the psychological element in all instinctive behavior. The conscious tendency to react may be distinguished from the act itself. The term *impulse* is used to denote this urge or con-

sciousness of a tendency to act, whether native or acquired, when a proper situation arises. If there is no opportunity to act, we experience a craving or a want, but not an impulse. The movement itself is not the tendency nor the awareness of this tendency, but its result. The action as a whole may be spoken of as an *impulsive action*.

The term impulse applies to such tendencies as looking around when one hears an unfamiliar noise, taking food when one is hungry, striking back when one is struck, dodging an approaching automobile, sniffing (smelling) if there is an odor of burning cloth or rubber. Other examples would include the tendencies to think, to seek knowledge or work, to overcome obstacles, to solve problems and tendencies, to enjoy satisfying situations, and to avoid annoying ones. Impulses take many forms and vary greatly in strength.

The impulse differs from the reflex in several important respects. In reflex action, the response follows immediately upon the presentation of the stimulus, while an impulse may or may not follow immediately. In the intelligent human adult the impulsive act usually occurs in connection with and often under the direction of volition. Impulsive actions, unlike reflex actions, involve the whole organism. Reflex actions are always responses to comparatively simple stimuli, while impulsive actions very frequently involve complicated situations. Impulsive action takes place only in connection with consciousness, whereas reflexes, excepting the cortical reflexes, may equally well be elicited from an unconscious individual. Reflexes, except those of the cortex, function independently of volition.¹ In the impulse, on the other hand, volition guides and directs the movement of response.

Many of the greatest acts of service are performed impulsively under the drive of a burning passion. If the doer had paused to deliberate and consider the wisdom of the act, he

¹ The term reflex is used in its broadest sense and not as synonymous with cerebral and spinal reflexes, which do function independent of volition.

would in many cases never undertake the task or would have failed in its performance. An impulse is the important drive to action in all highly efficient and pleasurable work. The control of the impulses constitutes one of the important tasks of education.

Instinctive Action. An *instinct* is a term usually defined as an inborn tendency to act in a certain way under given stimuli without (necessarily) any foresight of the end to be accomplished, and without previous education in the performance. The adjective *instinctive* is a more appropriate term to use than the plural noun *instincts*. Instinctive actions are normally blended into habitual and voluntary actions. In other words, instinctive tendencies sharply defined, separate, and independent do not exist. Environment is constantly changing and the individual's organism is never twice the same. A "one-to-one" correspondence between instinctive acts and situations provoking them does not exist.¹

Original actions are modified by experience almost from the first date of their appearance. The learning or habit factor modifies not only the instinctive response itself, but also alters the situation that originally evoked the native response. The gradual maturing of the organism, the increasing complexity of the stimuli and situations evoking all responses made after infancy, and the additional fact that instinctive actions seem often to take the same avenues of expression, are additional difficulties in the way of establishing a "one-to-one" correspondence and classification of instincts. It makes little difference, however, whether we call an action a habit or instinct so long as we mean a certain definite response of a universal and fundamental character. Childhood is, therefore, to be regarded not primarily as a period for the internal ripening of systems of behavior but as an opportunity which must be used in learning. While some behavior traits appear to result from the "ripening" or maturing of truly innate coördinations, it is probably better

¹ Dewey, *Human Nature and Conduct*, pp.150-156.

to begin at birth with the simple reflexes which are demonstrably innate. Experiments show the processes of grasping, reaching, use of both hands, tropistic eye response, the Babinski reflex, sitting alone, crawling, extensor thrust, and defensive reactions, in infants less than ten months of age.

Three simple emotional patterns may be observed: fear, rage, and love. Adults have various fears which do not appear in infants. Many of these can be accounted for on the basis of conditioned responses, although, as was suggested above, some of the higher types of behavior cannot apparently be so explained.

Instinctive Activity Distinguished from Simple Reflex Activity. Some authorities consider instinctive activities to be the same as chains of reflex actions. In this sense, instinctive blends and tendencies differ from simple reflex activities only in degree of their complexity rather than in kind. There are, however, certain differences that need to be noted. The simple reflex involves a simple reaction pattern. Instinctive activities, taking a more uniform course, involve many coördinated and interrelated patterns. A reflex is merely set off by the stimulus, whereas the instinctive activity is adapted to it. In the gang tendency, we cannot say at any particular stage of its development what the boy or girl will do next; but one can say that the boy must now fulfill this or that requirement.¹ Simple reflex activity is typically passive and often unaccompanied by consciousness, while instinctive behavior is significantly active in its search for stimuli. Instinctive behavior is accompanied and controlled in the main by consciousness and exhibits greater adaptability than reflexes. It is very modifiable and may become integrated into more complex reactions, while the fundamental reflexes remain practically constant. Moreover, instinctive activities have a forward direction that is characteristic of voluntary action.

Have We Any Instincts? J. B. Watson, the most radical of all behaviorists, believes that in man's repertoire of struc-

¹ Koffka, *Growth of the Mind*. Moore, *Dynamic Psychology*.

ture and function there is nothing corresponding to what is called instinct. He believes that the behavior tendencies that have been called instinct are largely the result of training.

Opposed to this view is a body of evidence. Even Watson admits that the babe in the nursery will manifest fear, rage, and love in response to certain definite stimuli. In the sense that these are unlearned tendencies they may be thought of as instinctive tendencies since they are based on original connections of neurones in the central nervous system. However, these instinctive tendencies cannot be marked off sharply one from another. They are of an indefinite variety, blending with one another into habituated conscious and voluntary activities. They are not latent intellectual powers requiring exercise for their perfection. They are simple tendencies to respond to stimuli or situations so as to bring about other changes. As Woodworth points out,¹ the argument that the concept of instinct is superfluous because all that is inherited reduces to structure would rule out habit, reflex, and emotion as well. To drop the one and keep the other would necessitate a complete recasting of the descriptions of behavior. The argument emphasizing the impossibility of distinguishing native from acquired behavior appears illogical since it would likewise necessitate omitting all mention of acquired activities. The fact that an instinct can be analyzed into simpler activities applies equally well to other concepts of complex performances. Known facts do substantiate the existence of a few instinctive tendencies. Nutritive behavior, hunger, sleep, and sex behavior are examples of instinctive tendencies which may be considered as a "serial performance of much regularity, provided as an integrated whole by the native constitution of the individual."²

Classification of Instinctive Tendencies. There have been many attempts at classification of instinctive tendencies.

¹ Woodworth, "A Justification of the Concept of Instinct." *Journal of Abnormal and Social Psychology*, Vol. XXII, pp. 3-11, 1927.

² Even these may be regarded merely as the result of training.

James names twenty-eight special human instinct tendencies with nine subordinate varieties. Thorndike enumerates forty-two specific types of instinctive action. McDougall notes seven primary and four secondary instinct tendencies. A very satisfactory American classification has been made by H. C. Warren. One of the best classifications is that of Drever, an English psychologist, who submits the following classification of innate action tendencies.¹

I. Appetite tendencies

1. General

Seeking pleasure
Avoiding pain

2. Specific

Hunger
Thirst
Sleep
Sex

II. Instinct tendencies

1. General

Play
Experimentation
Imitation
Sympathy
Suggestibility

2. Specific

1'. Pure

Reactions of adjustment and attention
Reactions of prehension
Reactions of locomotion
Reactions of vocalization

¹ Drever, *Instinct in Man*.

2'. Emotional

Fear
Anger
Hunting
Acquisitiveness
Curiosity
Gregariousness
Courtship
Self-display
Parental

The teacher should be informed concerning the following instinct tendencies and the ways in which they can be stimulated and directed in the interests of the individual and of society: physical and mental activity, food-getting, teasing, possessing and collecting, kindness and sympathy, gregariousness, desire for approval and display, rivalry, fighting, and sex.

Experimental Evidence of the Instinctive Basis of Emotion. Experimental researches by Watson and others with young infants give convincing evidence of the unlearned character of three fundamental emotional trends. These instinctive emotions, fear, rage, and love, appear very early, that is, during the first few hours after birth. They may very properly be considered as instinctive.

Value of Instinct in Education. Instinctive tendencies and reflexes enable the child to survive during a period when his learned equipment is almost nil; they serve as a basis for all education and furnish the drive for many activities. Although the instinctive tendencies are inadequate in enabling man to make the necessary adjustments in modern civilized society, every one is good for something. The desirable ones are to be perpetuated; the undesirable are to be redirected.

Modification of Instinctive Tendencies.¹ There are three

¹Instinctive tendencies may be conditioned in the same way as reflexes. The three methods suggested here are methods of conditioning and reconditioning.

general methods of modifying instinctive tendencies. The tendency can be strengthened through use or exercise. The rivalry tendency is strengthened if the teacher encourages the child repeatedly to make a better record this week than last week. Stimulation or use must not be used with undesirable tendencies. Such tendencies may be weakened through disuse, that is, by removing every favorable stimulus to the reaction so that it will not occur. The method of disuse is useful only as a temporary expedient with very young or handicapped children.

A second method in which instinctive tendencies may be strengthened is by associating some satisfaction in the learner's mind with the instinctive reaction. Satisfaction increases the probability that the response will be made again. If the learner is admired and praised by his fellows when he performs acts or makes a good record in school, the tendency to behave in this way is strengthened. If the tendency is an undesirable one, it may be modified by attaching discomfort or pain to its expression. The child who is quarrelsome or overbearing, for example, may be changed for the better by the scorn of his group.

In the administering of rewards, and punishments, care must be taken to associate them with the deed and not with the individual who administers them. The younger the child, the closer must be the association with the deed. Moreover, neither punishment nor disuse are satisfactory methods of redirecting strong impulses. Negative methods should be used sparingly, and when resorted to should be followed by something constructive. In general, the closer a reward or punishment can be attached to the situation to which it applies, the more effective it will be in strengthening or weakening the tendency. Every child should learn the inevitable relation of cause and effect.

A third method of modifying original tendencies involves the principles of substitution and sublimation. This method makes possible the substitution of a desirable response for an undesirable one. The substitute response bond may be built so strong that it will displace the original response. The youth with fits

of uncontrolled passion is made to see the value of poise and self-control; and the gang bent on a pilfering expedition is led to search for geological treasures.

Sublimation is used here as a form of substitute response (conditioning) or reconditioning the individual by changing his ideas, attitudes, prejudices, ideals, or standards of value, so that the action finds expression consistently on higher levels. Thus, to fight, not with one's fists just to make another submissive, but with ideas for a just cause, is sublimation.

Imitative Action. While imitation may be said to have its roots in instinctive behavior, it is not the result of a single instinctive tendency. Imitation is a term variously used. Sometimes it has denoted the general fact of the repetition of one individual's thoughts, feelings, and actions by other individuals. In this sense the term has a connotation opposite to invention. Imitation is also used to denote the unconscious and involuntary influence of concrete behavior of one individual upon other individuals, as opposed to the influence of explanations, commands, and lessons. The unconscious influence of personal example, manners, styles, morals, attitudes, and ideals come under this category. The behavior of other people exerts a twofold influence: serving as a stimulus to action and as a model or standard by which the satisfactoriness of an act is judged. Imitative tendencies seem to be developed through learning, there being no substantial evidence of such innate tendencies.

It is highly important that the teacher or leader be the kind of person that good parents want their children to imitate. That teachers should impress the plastic minds of growing and developing children by example as well as precept, has been long recognized. Pupils must be given many opportunities to witness activities of good people. What boy is not thrilled by the exploits of Wilfred Grenfell, the Labrador Doctor? What boy will not be a better boy because he has read the story of Lindbergh? The words of the poet ring true, "I am a part of all I have met."

Volitional Action. In contrast to involuntary action, voluntary action is dependent on ideas and concepts. They involve bodily activity just as truly as do the lower types of action. As the sensory, ideational, attentive, emotional, interest, and attitude factors become more and more dominant in their control of the individual, we find the explanation of individual conduct not in the impulses, or the present situation confronting the individual, but in his past experience and his conscious projection of the future. Thus voluntary choice depends on a highly complex and interrelated behavior pattern, and is related to the higher conscious processes.

We have seen that the most complex of all action is volitional in character. *Volition* is the capacity to delay and control action. Any adequate discussion of volitional action or "will" must include much that has been said regarding the native tendencies to action, since volitional processes depend upon the native equipment of reflexes, impulses, and instinct.

The development of "will" or volition means the modification and direction of our native tendencies according to some guiding principles. The mechanism involves: (1) some doubt, crisis, or conflict of desires; (2) deliberation; and (3) decision or choice. "Will" is a general term that denotes the sum total of the influences, inherited and acquired, that determine the course of action.¹ It is the sum of all the conditions of choice.² The deliberative phase of the action implies a weighing and comparing. Out of this experience there comes a decision which in turn releases the muscular tension and results in action. The particular action chosen may be more instinctive than acquired, more determined by desires than ideals, more satisfying immediately than remotely so, or it may be just the opposite of these. The particular decision any individual will make is determined in very large measure by his past experiences. The action chosen is the one that proved most useful in the past, or which

¹ Titchener, *A Beginner's Psychology*.

² Pillsbury, *Essentials of Psychology*.

appears to be the best so far as the individual can predict the future. No "will" is absolutely free—it is conditioned by biological and social inheritance. The individual is free in a limited way. He possesses initiative, the power to learn, and ability to adjust himself in the light of past experience and the contemplated future. He is free in the sense that consciousness is forward-looking and controlled by the future as well as the past. Education of the right sort aids him in gaining greater freedom.

These facts have considerable significance. The choice the child makes today has its foundation in the experiences of yesterday. The choice the child will make tomorrow will be conditioned similarly, but the teacher today can largely determine the child's decisions tomorrow. The individual's inborn capacity also affects the decisions made. The feeble-minded individual, with much less elaborate neurone patterns, is not capable of making decisions of a high order. Finally, the satisfyingness or annoyance that attends either line of action in case of a conflict will have a strong determining influence in solving the problem. If the emotional content relating to either act is pleasant, we may have a facilitatory action of the autonomic system leading to action. If, on the other hand, the emotional content relating to either act is annoying, there may be an inhibitory action of the autonomic nervous system whereby the neural path to that action is blocked. Volitional action or "will" is a consummate expression of all that has entered into the individual's life. It involves the whole individual. It is a matter of inheritance plus experience. Any training to deliberate and choose in accordance with the dictum of society must include a training of the entire individual. Professor James has stated the same thought in different words when he says, "The elements of will are ideas, habit of attention, and habit of action." Immature minds, including those of mental defectives, are weak in volition because they lack the proper association neurone patterns; or in James's terms, they possess

few ideas, weak attention, and few habits of action. Briefly stated, the best training to be given children along this line should include: (1) Placing responsibility on the child comparable with his stage of development and experience. He should be given the opportunity to make decisions. (2) Building ideals that are in harmony with the conduct we wish to secure. (3) Training the individual in habits of action in keeping with right ideas and ideals.

Questions and Problems

1. What is the meaning of *original nature*?
2. Distinguish between nature and nurture.
3. What is included in man's repertoire of original nature?
4. Distinguish between reflexes and instinct tendencies.
5. What is meant by the conditioning reflexes?
6. What are the chief methods of modifying instinct tendencies?
7. Discuss the proposition that all education must begin with instinct.
8. Distinguish between conditioning and reconditioning.
9. How may a knowledge of original nature aid the teacher in making her instruction more effective?
10. Habit and volition are forms of learned behavior. Explain fully.
11. Why is it preferable to use the term instinctive tendencies or instinct, rather than the term instincts?
12. What is meant by volition? To what extent should school children be impressed with the fact that they have a "hand in their own making"?
13. "Within limits imposed by heredity and environing conditions, children can become what they will." Explain.
14. How should you condition a child of eight years who is constantly getting into fights with other children?
15. Make a list of instinct tendencies found in children of school age, which teachers must consciously or unconsciously direct and modify in the interest of the social order?
16. To what extent do superintendents and principals call their teachers' attention to instinct tendencies and activities and point out ways of modifying them?
17. Native capacity to learn is a part of the individual's original

capital. Is it possible to increase the amount of native ability to learn? Explain.

18. Do all people have the same kind and amount of original nature or do individual variations exist? Explain.

19. What are the sources of original nature? What are the characteristics of original nature?

20. Is there any relation between instinct tendencies and interests? Explain.

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James Rowland Angell

CHAPTER II

NATURE AND NURTURE

VARIOUS writers have discussed the relative influence of heredity, environment, training, and will. Galton, O. W. Holmes, Thorndike, and Goddard have emphasized the all-importance of heredity; Cattell, Ward, Judd, and Watson have tended to emphasize environment; while Herman H. Horne has been the protagonist for the prepotency of the will impulse.

We mean by "nature" all that is involved in the natural inheritance, the vehicle of which is the germ plasm. By nurture we mean all manner of surrounding influences — climate, soil, house, food, work, play, association, and education. In the case of man, nurture begins with his conception. It means much to him for two reasons. First, the full development of a heritable character depends on its receiving appropriate nurture. Second, peculiarities in nurture produce corresponding physical and mental modifications.

Galton's studies and Thorndike's evidence from the study of twins point to nature as the prepotent influence in determining intellectual ability. From statistical investigations, Professor Karl Pearson has concluded that "the degree of dependence of the child on the characters of its parentage is ten times as intense as its degree of dependence on the character of its home or uprearing." These conclusions are important, but they must not lead us to depreciate nurture and will. It should be remembered that nurture begins nine months before the birth of the child, that nurture gives us a readily available leverage, and that it is useless to make too much of an antithesis between what are so obviously complementary factors.

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Heredity needs emphasis for the improvement of future stock ; environment affects the serviceableness of the present. At all times the teacher should teach as if environment, education, and training were everything ; and she should impress upon the children the importance of making wise decisions and of the "power of will." "Man is born in part (heredity), he is made in part (environment), and in part he makes himself (will)." ¹

Are Acquired Characters Inherited? It is true that any given individual may acquire new characteristics which he himself did not inherit. The question under discussion is one of great racial importance. Do functional or environmental modifications of a parent's body so affect the gametes or germ cells that the offspring shows the original modifications? Darwin, Haeckel, Spencer, Cope, Tower, and Lamarck answer yes. Sir Francis Galton, Karl Pearson, Edward L. Thorndike, and perhaps the rank and file of biologists, led by Weismann, Conklin, and Jordan, say no. The problem is of great import for evolutionists and for all who are interested in race improvement. We do know that we transmit by heredity our heredity ; and any effects of our acquisitions upon the vital forces for good or evil, are transmitted.

Are Certain Diseases Inherited? Tendencies to disease are very definitely inherited but specific diseases as such are probably not inherited. "The process," says Professor Thomson, "is not transmitted, but the potentiality of it is involved in some peculiarity in the organization of the germ plasm . . . there are endless illustrations of the fact that a pathological diathesis — rheumatic, gouty, neurotic, or the like — may persist and express itself similarly, even in spite of altered conditions of life, throughout many generations." ²

For purpose of illustration, let us take the case of tuberculosis. While the child of tubercular parent or parents does not directly inherit the germ, he will have less resistance against the germ,

¹ Horne, *Idealism in Education*, p. 140.

² Thomson, *Heredity*, p. 70.

and unless he keeps his body in absolutely fit condition, he will be more likely to contract the disease than the average person. The devitalized constitution that predisposes the child to the particular disease is heritable. Conklin, in writing on this subject says: "If a disease is due to some defect in the hereditary constitution, it is inherited; otherwise, according to our definition of heredity, it is not. Of course, no disease develops without extrinsic causes, but when one individual takes a disease while another under the same condition does not, the differential cause may be an inherited one, or it may be due to differences in the previous conditions of life. There is no doubt that certain diseases run in families and have the appearance of being inherited, but in this case, as in many others, it is extremely difficult in the absence of experiments to distinguish between effects due to intrinsic causes and those due to extrinsic ones."¹

Children of tubercular parents are very likely to possess tendencies toward tuberculosis which are seen in X-ray photographs. Such children may outgrow these tendencies if placed under proper treatment. If the individual is a member of a family having a case of insanity or epilepsy, extreme care should be given to his early environment and training. A sunny disposition or an optimistic philosophy of life is a great asset. The school should aid in developing such outlooks on life.

A knowledge of heredity on the part of the teacher will enable him to be more efficient. Every teacher should study carefully the potentialities, general and special, of each pupil, and then strive to develop those capacities. In the past, and even to a large extent at the present time, the teacher spends much time in trying to get pupils to learn that for which they have but little need or aptitude and frequently in doing so she overlooks some important latent abilities. •

Regardless of the origin of tendencies toward physical weakness, whether through heredity or environment or both, the

¹ Conklin, E. G., "The Phenomena of Inheritance." *Popular Science Monthly*, October, 1914.

teacher has three important functions in promoting health: (1) detection of physical defects; (2) detection of evidences of disease symptoms; and (3) the promotion of health through the development of health habits and practices. The teacher should watch for symptoms of poor nutrition, near or far sight, eye fatigue, mouth breathing, bad teeth, stoop-shoulders, flat chest, scoliosis, nervous exhaustion, chorea, abnormal gait, defective hearing, and pediculosis, and should give attention to bad breath, body odor, and abnormal condition of clothing and body cleanliness. Necessary cases should be referred to the medical inspector or the nurse as early as possible. The teacher can accomplish most valuable results through follow-up work.

The teacher's duties also include detection of evidences of pink eye, granulated eyelids, and trachoma; attention to running nose, flushed face, sneezing, nausea, headache, and back-ache; and the recognition of symptoms of children's diseases such as chickenpox, measles, mumps, scarlet fever, diphtheria, and whooping cough, and such other symptoms as may warn of possible illness. Children showing symptoms of disease should be referred immediately to the medical inspector, or the nurse, or in the absence of both, to the principal of the school. The teacher needs to be familiar with and be guided by facts pertaining to the physical history of each child in her classroom.

Some Scientific Studies of Human Heredity.¹ Woods² made an exhaustive study of inheritance among eight hundred thirty-two members representative of all the important royal families of Europe. His investigation involved estimates of mental, moral, and physical qualities. He has convincingly shown that royalty furnishes many instances of the transmission of mental peculiarities. A few royal families have degenerated, but others have steadily improved. Among these eight hundred thirty-two cases are twenty-five world geniuses, which perhaps no equal number of random names of a class would

¹ For a discussion of the inheritance of intelligence see Chapter III.

² Woods, *Mental and Moral Heredity in Royalty*.

yield. "The royal breed is superior to any other one family, be it that of noble or commoner." Professor Yerkes cites an interesting instance of the transmission of mental peculiarities, from which we quote:

"Queen Isabella (to whom Columbus owed so much) was the daughter of an imbecile father and an insane mother. But far from being mentally deficient, she was renowned for her intellectual gifts. She married Ferdinand, who, although not her equal intellectually, was mentally sound and of fair ability. One of their daughters was Joanna, "the mad." In her, defects of the maternal grandparents reappeared. Another daughter, Mary, was not defective. Joanna married a weakling mentally and to them was born Charles V, a victim of melancholia, and Catherine, who was mentally sound. Mary married Emanuel, also a weakling, and of their children, a daughter, Isabel, was normal; a son, John III, was weak-minded. He married his cousin, Catherine, and their daughter, Mary, later married Philip II, the morose and cruel son of Charles V and his wife, who was also his cousin, Isabel. To Philip II and Mary was born Don Carlos, one of the most depraved and cruel of men."¹

1. **The Jukes.**² This contribution was made by R. L. Dugdale, who was sent by the New York Prison Association to visit and report upon thirteen of the county jails in the state. In one of these he found six different persons all of whom were related. This excited his curiosity, and his book on *The Jukes* was the result. "Max" was the founder of this infamous family that for generations contributed to crime, pauperism, disease, viciousness, and immorality. Of 540 whose histories were known in 1877, 310 had spent on the aggregate 2300 years in almshouses, 440 were physical wrecks, 130 were convicted criminals, and over half the women were prostitutes. None had ever held office or served the country in any useful way. Up

¹ Yerkes, *Introduction to Psychology*, p. 414.

² Dugdale, "The Jukes."

to that year the family had cost the state more than a million and a quarter dollars. A more recent study of Dugdale's findings leads to the assumption that environment rather than heredity was the primary cause of the conditions found.

The "Ishmaelites" of Indiana and the "Hickory Family" of Ohio are only slightly less striking examples of what a bad heritage and a bad environment may produce.

2. The Edwards-Tuttle Family.¹ This study made by Dr. Winship illustrates the other extreme. While Max Juke was the progenitor of 1200 persons mostly paupers and criminals, Jonathan Edwards was the founder of a family of 1400 of the country's best and most useful citizens. The members of this family have repeatedly occupied positions of prominence and trust of every kind. No member of the family is known to have been convicted of crime. We shall use only a few illustrations. One hundred twenty of Yale's graduates have been direct descendants of Edwards. The family has furnished thirteen college presidents, and more than one hundred professors. They have founded important academies and seminaries. They have furnished scholars, statesmen, lawyers, financiers, and other illustrious men and women. Similarly, the Adams family of Massachusetts has furnished leading statesmen, scholars, and college presidents.

3. The Kallikak Family.² In the famous study by Dr. Goddard, we have a single paternal head of two families; one, the 496 descendants of "Martin Kallikak" and his lawful wife, both of good ancestry; the other, the 480 descendants of the same father and a feeble-minded girl. The investigation started with a certain Deborah Kallikak who was an inmate of the Vineland Training School in New Jersey, where Dr. Goddard was the psychologist. All of the descendants of the lawful wife were of normal mentality except two, and these were not feeble-minded. Of the descendants by the feeble-minded

¹ Winship, *The Edwards-Tuttle Family*.

² Goddard, *The Kallikak Family*.

woman, 262 were distinctly feeble-minded, many others were less than mediocre, and none were of exceptional ability. In conclusion Goddard says: "The fact that the descendants of both the normal and the feeble-minded mother have been traced and studied in every conceivable environment, and that the respective strains have always been true to type, tend to confirm the belief that heredity has been the determining factor in the formation of their respective characters."¹

Galton's Laws. Original nature in terms of family inheritance is not determined merely by the natures of the parents. There are two lines of ancestors concerned in the production of every child. Sir Francis Galton, a cousin of Charles Darwin, in his researches on heredity reached the conclusion that the contribution of the immediate ancestors of the offspring exceeds that of any other ancestors and equals that of all the others. That is, his *law of ancestral inheritance* means that one-half of a child's original body structure and organization is due to his parents, one-fourth to his grandparents, one-eighth to his great grandparents, and so on back in geometrical ratio. This is a very simple explanation, but unfortunately it fails to explain from what ancestors a child gets his particular traits, or why some children are so like their parents and others so unlike. Neither does it enable us to predict the transmission of any specific heritable character.

Another law proposed by Galton is the *law of filial regression*. While it is commonly observed to hold true in a large number of cases it is open to some of the same criticisms as his other law. It does not obtain where the lines are germinally pure.² This law was based on a study of the inheritance of human stature and some other qualities which led Galton to recognize a marked tendency to mediocrity or towards the average of the

¹ A subsequent study of the Kallikak Family points to environment as one of the chief causes of the lot of the Kallikak Family. The studies made of the Jukes and the Kallikaks were not carefully controlled and the conclusions should not be subscribed to without mental reservations.

² Castle, *Genetics and Eugenics*, p. 295.

stock. That is, a parent of average height will produce children of average height; children of very tall parents, on the other hand, tend to be taller than the average, but not so tall as the parents; while children of very short parents tend to be shorter than the average but not so short as the parents. All children probably tend to approach the average mentally as well as physically. According to this law, the more gifted the parent is by nature, the smaller chance for having a son or daughter who is equally gifted. But the law is evenhanded; it works both ways. If it discounts the gifted parent's hope of having children equally gifted, it no less discounts the possibility of his children inheriting all of his weaknesses and diseases.¹

On the mental side, the law can be further illustrated as follows:

Children of very gifted parents tend to be more gifted than the average but not so superior as their parents; while children of dull or stupid parents tend to be less stupid than their parents but more so than the average. The law of filial regression works upward as well as downward, forward as well as backward. It has nothing to do with reversion or deterioration. The investigations made by Karl Pearson and his followers tend to substantiate in the main the contentions of Galton. But this law has been disproved by still more recent studies in which germinally pure lines have been observed.

Reversion includes a variety of phenomena. Through arrest of development during prenatal life a child may be born with a harelip or cleft palate. A perturbation of the regulative system may bring about a subnormal type of individual known as a *cretin*. Recessive characters in Mendelian inheritance may skip a generation or several generations. Fortunately, true reversions seem to be very uncommon.

Mendelian Inheritance. Mendel's Law explains very clearly how traits or qualities may occur in children, making

¹Galton, *Inquiries into Human Faculties*.

them surprisingly unlike either parent in one particular trait, but entirely like some ancestor three or four generations ago. Gregor Johann Mendel, an Austrian monk, lived in the second half of the nineteenth century. In the garden connected with the monastic school at Brunn, where he taught the physical and natural sciences, he carried out experiments for eight years. In his earlier experiments he used tall and dwarf peas of pure strains, crossing them artificially and noting the results in several subsequent generations. Mendel formulated his discoveries into what has since become known as *Mendel's Law*, which may be stated as follows: Hereditary characters are ordinarily independent elements which — after the first generation, in which one element is dominant over the other — tend to reappear in the ratio of three dominant to one recessive in the second generation, the recessive breeding thereafter true, but the dominants repeating the history of the first generation in two cases and becoming pure recessive thereafter in the third case.

The characteristics which he found to be the stronger at first he called "dominant" characteristics. Those which were crowded out were called "recessive."

To illustrate this law, when two varieties of a species having different characteristics are crossed in breeding, the resulting hybrid generation resembles one parent, the "dominant"; the "recessive" characteristic of the other is apparently suppressed, but is really latent, for it will appear in later generations. When the hybrids are inbred, one-fourth of the offspring have the "recessive" characteristic of one grandparent, and one-fourth have the dominant characteristic of the other. The other half may either resemble the hybrid parent, or be indistinguishable from the one-fourth "dominants" till they in turn produce another generation. Mendel found this to be true when he crossed tall edible peas with dwarf edible peas. Also, black (dominant) Andalusian fowls mated with white (recessive) produce nothing but slaty blue. The blue hybrids, if

mated, produce in a brood of twelve, three white, three black, and six blue.

Briefly stated, his law comprises three facts: (1) pure bred mated with pure bred of same kind gives offspring pure bred; (2) pure bred mated with pure bred of different kind produces hybrid offspring; (3) hybrid mated with hybrid, the offspring will be one-half hybrid, one-quarter pure bred like grandfather, one-quarter pure bred like grandmother.

This remarkable mode of inheritance has been demonstrated to hold for a great diversity of organisms: in mice, rats, guinea pigs, cattle, rabbits, poultry, canaries, snails, silk moths; in beans, corn, wheat, and barley.

In the case of man, it is more difficult to draw definite conclusions on account of the complexity of the organism. In spite of these difficulties, studies have been made with the result that certain human traits appear to be inherited as *unit characters* in accordance with Mendelian proportions; for example, night-blindness, color of eyes, presenile cataract, certain kinds of feeble-mindedness¹ and epilepsy, curly hair (dominant), dark hair, normal nervous system, albinism, light to red hair, and short-fingeredness.

Mendel's Law has the idea of germinal continuity for one of its foundations. It conceives the hereditary relation as one between the parental and filial germ cells and not between the bodies of parent and offspring. Mendelism explains the organism as built up of a number of definite and separably inheritable characters.

Variations and Mutations. It is a well-known fact that no two organisms of any plant or animal are exactly alike; slight variations in structure occur in all. This furnishes material for Nature to use in her selection, and those forms whose varia-

¹ According to one theory, normal mentality is due to the presence of the unit character and feeble-mindedness due to its absence. Since the normal gradually shades off into the subnormal or feeble-minded, there is little or no ground for this theory.

tions tend to adapt them best to their environment will survive, while others perish.

Variations are of two different types. The first is known as minor or continuous *fluctuations*, in which the divergence from the parental character is relatively slight. The second is known as *mutations* or stable or discontinuous variation, where changes of a considerable amount occur at a single leap.

Fluctuations in man include slight changes in color, in proportions, in muscularity, in alertness, in activity of ductless glands, and the like. Mutations in man include healthy gigantism, well-proportioned calculating capacity, color-blindness, etc. Professor Hugo De Vries's interesting and important experiments and observations in the plant kingdom show that species often arise from one another by discontinuous leaps.

If there were no difference in individuals there would be no changes in species and there could be no improvement of cultivated plants. "Variation is at once the hope and despair of the breeder, the hope because it makes for new departures in a progressive direction; the despair because they include relapses and aberrations from the standard previously reached." The educator and the parent should be thoroughly aware of the potency of variations, lest they be thoroughly disappointed in some child who is "different" or "peculiar."

The term *variation* has widely different meanings when referring to different phenomena. In speaking of a species, variety means that the group is heterogeneous. Among school children, variation may consist of differences — physiological, mental, and social — between members of the same age, grade, or group. Every teacher knows that her pupils differ in intelligence, and in willingness to apply themselves. Some pupils succeed well in mathematical subjects, while other pupils make exceptional records in the languages or history. Some individuals have remarkable memories for names, others for faces, and still others for dates. Differences in imagination, in perception, in feeling, and in ability to think are equally striking.

Natural selection is one of the most important contributions of Darwinism. In the early days of mankind, the sifting was largely by means of natural selection. The individuals who were fittest tended to survive. By fittest, we mean those who were strongest, who profited most from previous experience, and who could best adapt themselves to their environment. As man grew more intelligent with the ages, he began to throw off the yoke of natural selection, and social selection began to play a larger part. Disease and war in the course of time were also means of selection. Undoubtedly, sex has also been a very important factor in selection.

Is Inheritance Specialized? We have already granted that near-ancestry has much to do with the make-up of the original nature of a child. Does inheritance define the general lines of development, or are the specific traits the result of family inheritance? Galton shows in his *Hereditary Genius* that "out of two hundred eighty-six judges more than one in every nine has been either father, son, or brother of another judge."¹ Concerning the relatives of eminent statesmen, he says: "The combination of high intellectual gifts, tact in dealing with men, power of expression in debate, and ability to endure exceedingly hard work is hereditary." Among these statesmen are: Pitt, Erskine, Marlborough, Brougham, Fox, Wilberforce, Cromwell, Adams, Mirabeau, and Richelieu. The investigations of the special abilities of school children bear out the same general truth.

Academic distinction furnishes us with innumerable illustrations. There are, for example, the trio of Thorndike brothers who are among the foremost university professors in their respective lines — psychology, English, and history. Then we have the Willoughby twins, famous in economics and political science. Equally good illustrations can be found in the case of

¹Statements like this should not weigh too heavily since environment, social status, and opportunity also favored the relatives of the two hundred eighty-six judges.

the McMurrys, Holmeses, Butlers, Adamsons, Russells, Deweys, Boltons, Angells, Lowells, Harpers, Jameses, McCrackens, Scotts, Fites, Fosdicks, and Farrands.

In general we can assert that special abilities tend to run in families. This fact does not preclude the existence of inheritance of a general character.

Social Heredity. Biological heredity must not be confused with social heredity. The former is passed from parent to child through the germ plasm; the latter is acquired by each individual. Our race color (black, white, yellow) is a matter of biological heredity, but the language we speak, the religions or political views we hold, and our attitudes toward college, fraternity, church, and country are matters of social heredity. The racial heritage of the child is highly complex. It is rapidly increasing in both quantity and complexity with each succeeding generation. This social environment into which a child enters at birth and in which he lives, is fundamental in determining his feelings, thoughts, and actions. From birth until death, the normal individual is more or less receptive to social standards, usages, and customs. "Rarely can the maturest minds so far succeed in emancipating themselves from this medium as to undertake independent reflection, while complete emancipation is impossible, for all the organs and modes of thought, and all the organs for constructing thoughts, have been molded or at least thoroughly imbued by it."¹

Eugenics: Control of Human Heredity. Eugenics has been defined as the science and art of race improvement. Its task is that of modifying the physical and mental constitution by means of knowledge furnished by the biological sciences. We shall limit our present discussion to the mental and physical improvement of human beings.

For the individual, there is no doubt that *eunoias*² and

¹Gumpłowicz, L., *Outlines of Sociology*, p. 157.

²Eunoias — "Make the will good." Euthenics — "Make the environment good." (Horne)

euthenics count for much, but *eugenics* goes deeper, touching the race. Permanent progress involves eugenic practices as well as the improvement of the environment.

If man has reached his present height with but little conscious human control, how can he best assist in his own making? This is our problem. If we cannot improve nature's method,¹ we can make nature work to better advantage by reducing if not eliminating the propagation of the unfit and increasing that of the fit.

The doctrine of *eugenics* was well stated by Oliver Wendell Holmes when he remarked that a person's education begins with his grandfather and his grandmother. Galton, the father of the *eugenics* movement, defines the science as follows: "The science of improving stock, which is by no means confined to questions of judicious mating but which, especially in the case of man, takes cognizance of all influences that tend in however remote a degree to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable than they otherwise would have had."²

It is obvious that, since man is man and the present customs prevail, whether fortunately or unfortunately, the methods of animal breeders cannot be applied *in toto* in the case of man.

The following measures are suggested in the interests of race improvement:

1. There should be either sterilization or segregation of the unfit. Only children who come from clean, sturdy, healthy, and intelligent stock are well born.

2. Youth should be instructed in sex matters at the right time and be given as much enlightenment as we possess in the making of a wise selection of a life partner. A good suggestion in the guidance of marital selection follows: "The clear lesson

¹Natural selection should not be understood to include such forces as accidents, communicable diseases, and the ravages of war. Accidents and diseases have eliminated the most fit as well as the least fit. Warfare has tended to eliminate only the most fit.

²Galton, *Inquiries into Human Faculties*, p. 17.

of Mendelian studies to human society is this: that when two parents with the same defect marry — and there is none of us without some defect — all of the progeny must have the same defect, and there is no remedy for the defect by education, but only, at the most in a few cases, by surgical operation . . . The only rule, a very general one, that can be given at present is that a person should select as consort one who is strong in those desirable qualities in which he is himself weak, but may be weak where he is strong.”¹

3. Teachers and parents must help create an attitude and sentiment in favor of children in the home of the biologically fit. Statistics show that the size of such families has shrunk considerably in the course of a hundred years. At the present time, it is the inferior stock which propagates fastest, while the superior stocks, without doubt, deliberately restrict childbearing. These facts, based upon investigations, lead us to the inference that, for the good of humanity, the more fit should become more fertile.

4. There is hope of some good coming indirectly by getting back to old-fashioned pride of race, pride in wholesome children, and by cultivating right attitudes and ideals along the lines of proper social and racial respect for marriage, high standards for physical and mental health, and by fostering sane prejudices against mismating and immorality.

Summary. Heredity and environment² are necessary for the development of every individual. The child is born with a biological hereditary equipment into a social inheritance which consists of the accumulations of the race through the centuries. The social heredity is acquired by the child through teaching and example. One of the most fundamental acquirements of the child is that of language. It is true that the vocalizing tendency is hereditary, but without contact with the influences

¹ Davenport, “Influences of Heredity on Human Society,” pp. 19, 21.

² A uniform environment does not affect all individuals uniformly. See Chapter VII on individual differences due to environment.

of civilization one would be little better off than an idiot. The mind or behavior of the adult is a joint product of biological and social heredity. Either contribution without the other would avail nothing.

Some of the main facts of heredity include the following: the similarity between offspring and parent; variation or dissimilarity among human beings; the existence of pure lines of heredity as shown by the transmission of the same characteristics generation after generation; the existence of hybrids; that modifications which are not transmitted to offspring may affect structure and function; that variations sometimes occur in pure lines of descent; recombinations of genes of the two parents in fertilization so as to produce variations which are neither mutations nor modifications and which are not transmitted to subsequent generations; and, what we inherit is body structure, physiological functions, reflexes, instincts, and capacities.

From the biological point of view, "Education is the superior adjustment of a conscious human being to his environment."¹

Questions and Problems

1. Distinguish between biological and social heredity.
2. Contrast the law of heredity with the law of variation.
3. What physical traits are transmitted from parent to child by inheritance? What mental traits are hereditary?
4. What is the science of eugenics? the science of genetics? the science of euthenics?
5. What are the three principal methods used by geneticists in their collection of data?
6. Describe in detail the mechanism of heredity.
7. What is Galton's Law of Filial Regression? his Law of Ancestral Inheritance? Are these laws valid? Why or why not?
8. What is meant by the term reversion as it is used in biology?
9. What is meant by Mendelian Inheritance? Give an illustration of this law.
10. What are mutations?
11. Is inheritance specialized?

¹Horne, *Philosophy of Education*, p. 52.

12. What are three fundamental causes of individual differences in human beings?
13. Are acquired characters inherited? Are diseases inherited?
14. Various studies have been made of brilliant and stupid families, such as the Kallikak, the Juke, and the Edwards. Discuss the proposition that environment played a larger rôle in producing the condition of the Kallikaks and the Jukes than did heredity.
15. To what extent does *race* account for variation in learning?
16. Outline an intelligent and practical program in eugenics.
17. Is a teacher justified in taking the view that there is no use for her to bother with Frank since he has a poor heredity and will never amount to anything? Explain your answer.

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CHAPTER III

INTELLIGENCE, ITS NATURE AND MEASUREMENT

ONE of the greatest movements in modern psychology has been the attempt to understand the nature of intelligence and to devise ways and means of measuring it. Let us begin with a consideration of the steps that led to this great movement.

The beginnings of quantitative psychology are to be found in the *Elemente der Psychophysik*, published by Fechner in 1860. This book was a compilation of observations from the different sciences, together with Fechner's own experiments in physics and physiology. Eighteen years later William Wundt established the first psychological laboratory, where he did perhaps more to encourage experimental work than any other modern psychologist. Many of his students, especially Titchener, Hall, Cattell, Kuelpe, Judd, Kraepelin, and Meumann, soon became interested in psychological experimentation. Techniques used in the laboratory became familiar to those working in the field of mental development and diagnosis. Psychiatrists dealing with exceptional children were eager to establish some means of measuring mentality. Their interest, however, was mainly in the pathological aspects. The first tests were not, therefore, designed to measure intelligence. They resulted from experimentation with various mental traits. Individual differences seemed to preclude the establishment of general principles. Psychologists consequently set about to devise mental tests for the purpose of studying the nature of these differences. These tests were gradually improved until finally the psychologists recognized that they were all to some degree measuring native capacity as a variable among individuals. The chief difficulty

in devising a suitable measuring instrument at that time was the lack of knowledge of intelligence itself. The next step, therefore, was to attempt to define intelligence. However, many so-called tests of intelligence had been devised before we had a symposium on the subject.

The Nature of Intelligence. What is intelligence? Psychologists vary somewhat in their opinions. Stern¹ defines it as "a general capacity of an individual consciously to adjust his thinking to new requirements. It is a general mental adaptability to new problems and situations of life." By this definition he attempts to differentiate intelligence from other mental capacities, such as memory, talent, and genius. The adjustment of one's thought to new situations distinguishes it from memory. The fact that it is a general capacity marks it as something apart from talent, or special abilities and disabilities. Binet's conception of intelligence emphasizes three characteristics of the thought process. These are:

1. Its tendency to take and maintain a definite direction.
2. The capacity to make adaptations for the purpose of attaining a desired end.
3. The power of self criticism.

In his definition, Colvin stresses what one has learned and can learn in the way of adjusting himself to his environment. Terman identifies intelligence with one's ability to carry on abstract thinking, and Henmon interprets it as the capacity for knowledge plus the knowledge possessed. The general factors of intelligence as summarized by Woodworth include retentiveness, responsiveness to relationships, persistence, submissiveness, and curiosity.

Pintner² regards intelligence as the "capacity for getting along well in all sorts of situations. It implies ease and rapidity in making adjustments and hence ease in breaking old habits and in forming new ones." A general summary of these opinions

¹ Stern, *Psychological Methods of Testing Intelligence*, p. 3.

² Pintner, R., in "Intelligence and Its Measurement," pp. 136-137.

makes intelligence the ability of the individual to adjust himself to any situation in his environment, but whether it is a single inborn capacity which is functioning, or a group of specific capacities is a question which has not yet been settled. Spearman in his correlation studies implies a general common factor in all mental performances. Thorndike¹ disagrees with Spearman and says that "The mind must be regarded not as a functional unit but as a multitude of functions, each of which is related closely only to a few of its fellows, and to the rest with greater and greater degrees of remoteness."

With such differences of opinion, it may seem preposterous to the layman to attempt to measure a thing the nature of which is not fully known, but as Stern points out, electricity was measured long before electric currents were understood, and many diseases were diagnosed and successfully treated before much was known of their real causes. Therefore the handicap of being unable to agree upon a definition of intelligence may be considered as but a slight hindrance in its measurement. The definitions disagree because of the different points of view held by individual psychologists and not so much because of an inability to understand intelligence. The tests that have been devised to measure it differ for the same reason.

It is not extravagant to say that hundreds of definitions of intelligence are offered in current literature, and that much more has been written in the field of mental measurement since the subject came into prominence than in any other phase of education. It is not essential to define intelligence specifically; and it may never be defined satisfactorily. The term as here used is just that mental trait which competent judges commonly consider as intelligence. Opinions as to the nature of intelligence seem to group themselves under three general heads:²

¹ Thorndike, E. L., *Educational Psychology*, Vol. III, pp. 364-366, New York, Teachers College, Columbia University, 1921.

² Ballard, P. B., "The Limit of the Growth of Intelligence." *British Journal of Psychology*, Vol. XII, p. 138, October, 1921.

1. Those opinions that regard intelligence as a single ability common to all intellectual processes.
2. Those that regard it as a group of two or three abilities of varying degrees of generality.
3. Those that regard it as representing no real entity, but merely as a convenient term for the average of all special abilities.

Whatever the nature of intelligence is, the majority of theorists would probably subscribe to the following: ¹

1. That intelligence is an innate mental ability which operates in many different ways.
2. That it is more fully manifested in the higher mental processes.
3. That it is especially active in dealing with novel situations.
4. That it is more concerned with dissecting, planning, and rearranging empirical data than with reception of impressions.
5. That it arrives at maturity when the subject is sixteen years of age or younger.

Intelligence as a Social Function. A person is judged to be intelligent according as he is guided not merely by second-hand ideas, but because as he meets a new difficulty he thinks out a fresh line of action appropriate to it. Intelligence is essentially a kind of foresight that anticipates the operation of the forces at work and prepares to adjust itself to them. Preparation of this kind is possible in that a situation in identical form never recurs. It always has elements whose operation is familiar. Intelligence is the power to anticipate how these elements will operate in novel combination; it is power to grasp, power of synthesis, and power of constructive vision.²

Intelligence, then, is based on memories but makes a free and constructive rather than a mechanical use of them. It is essentially a process of dealing with the unknown of discovery. Be-

¹ *Ibid.*, p. 140.

² Hobhouse, *Mind in Evolution*, Chaps. V-XIV.

havior which can be formulated in advance is essentially not intelligence.

Intelligence works by a tentative method. Its superiority lies in the fewness and effectiveness of its experiments. The mental staging of what is about to happen is almost never exact and true; but activity approaches success according to intelligence. Suppose, for instance, that a teacher is about to devise a test of intelligence involving one hundred new test elements. If the first draft of the test consists of but one hundred such elements, his work in testing with the use of this material is largely wasted and has to be done over again because of his failure to realize that many of these elements will eventually have to be discarded and others substituted. If on the other hand a thousand test elements are listed as possible test material, the result of the initial trial will probably provide the required number of elements suitable for the test when in final form.

This selection and organization according to intelligence is really participation in the social process. The mental and social are merely phases of the same mind. In the above illustration there would be no need for mental measurement at all except as an individual is a member of one or more groups of human beings. The whole procedure is a mental staging of a scene in the life of society.

Intelligence works through a social process. There is nothing exclusively individual about it. Intelligence is part of our social heritage inseparable from communication and discussion. Groups of humanity have had a public intelligence illuminating more or less the situations and endeavors of the group. The chief function of the institution is to furnish an organization on the basis of which public intelligence may work effectively. It preserves race experience for the use of intelligence.

Intelligence is not something apart from sentiment and passion. It is rather the organization and development of the whole mental process. Our sentiments and intensified emotions are bases for intelligent functioning.

As applied to our social life, intelligence is essentially dramatic in character. The most intelligent individual is he who can adequately dramatize that part of the social process with which he is involved.

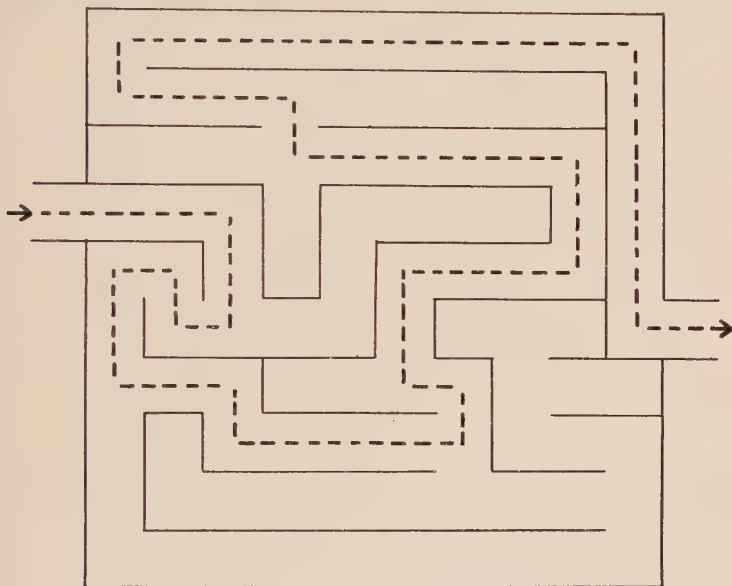
The Ascent from Instinct to Intelligence. An animal having but one response *a* to a given situation is a creature of blind instinct and is not considered to possess intelligence. It survives only as the one response is suitable for its protection. Such an organism makes the same response again and again regardless of previous failure, does not profit by experience, and seems to have no memory.

The next higher type is an animal that has two or more responses, such as *a*, *b*, *c*, and *d*. It makes response *a* to a situation and fails. Then it may try *b*, *c*, and *d* in order until it meets with success. If it returns to previously unsuccessful responses after having failed, we should deny its having any high degree of intelligence. It exhibits memory and the use of experience according as it does not repeat unsuccessful responses.

An animal which has some means of anticipating the success or failure of a response, without having to try that response, belongs to a still higher type. It conserves its energies and does not waste time. The source of such anticipation lies in the use of some sort of imagery. Instead of actual performance the animal has an image of the performance and of resultant success or failure. If images can then arise they can be used to carry out a chain of responses. A baby, for instance, may imagine a chain of responses. The sound of footsteps, the opening and closing of the door, the sound of the mother's voice, the embrace which follows, all form a chain of anticipations. Images can be experienced in terms of each of the senses as seeing, hearing, feeling, smelling, and tasting. Woodrow says: "Almost any image can be used as a vehicle for any thought, just as different sounds or words are used in different languages, all to indicate the same object. Admitting, then, that imagery of

some sort is indispensable in all mental operations, it must be conceded that in general the sort of imagery, visual or auditory, distinct or vague, is of little import.”¹

Animals employing imagery may be considered to have gone at least one step toward that kind of behavior which we call reasoning. In the study of imagery and reasoning, mazes



ILLUSTRATING A TYPE OF MAZE

(From Army Beta Test One)

and problem boxes have been widely used to discover the way in which imagery gradually comes into the human solving of problems. If an adult is asked to show by marking with a pencil the shortest path he would take to reach the center of a maze, he does not make excursions with his pencil into the various blind alleys and then return. Such behavior is penalized and considered more or less unintelligent because of the use of “trial

¹ Woodrow, *Brightness and Dullness in Children*, p. 167.

and error." He does, however, make these excursions in imagination except as he has had previous practice with the same or a similar maze.

General and Special Abilities. Two questions regarding intellectual ability have constantly been presented. (1) Is the degree of ability to which an individual can attain due mainly to heredity or to environment? (2) Is the individual's ability general or specific; can it be guided by training and opportunity along any channel, or is its direction and its amount settled by innate tendencies?

The rise of intelligence and quantitative measurement has again brought these questions to the front and has possibly submitted new evidence. Theoretically, intellectual powers may be general, but innate specific interests may impel one to employ them in special directions. If this is true, the result is practically an inheritance of special abilities. Then the question arises as to whether interest creates ability or ability interest.

Professor Spearman's experiments, during the first decade of this century, led him to present his Two-Factor Theory. According to that hypothesis, ability is the sum of two factors; one general and common to all mental processes, the other specific and peculiar to that particular activity. Spearman's "general ability" is common to all activities and in the low plane from which special abilities spring. It is the horizontal line below which no performance falls. His concept is of theoretical importance but subject to so much controversy that it cannot be considered factual.

Claparède's global intelligence is indicated graphically by a horizontal line running through the zigzag with some actual performance points above and some below it. This average will remain dominant while intelligence quotients are being so generally referred to in educational literature. There is a great social tragedy here in America in the fact that apparently we do not care about peaks or special talents, but are placing such emphasis on the education of the average or mediocre.

We have stressed the education of the inferior but have ignored the needs for and value of training the superior.

The chief facts pertaining to special talents are obtained for experimental and statistical evidence chiefly from correlational investigation. A coefficient of correlation is an indicated resemblance between two measures of the same collection of individuals, organisms, or objects. The coefficient is usually expressed in decimal form such as .90, .0, and -.40. When the coefficient $r = .90$ there is almost a perfect resemblance. When $r = 0$ there is no indication of resemblance; and when $r = -.40$ there is not only no indicated resemblance, but there is a tendency for groups to be different instead of alike with reference to the traits measured.

Most of the correlations obtained in comparing different abilities are positive, almost never negative. This means that if a man is above average in one ability he is likely to be above average in another; or if a pupil gets a high score in one objective test in mathematics he is likely to obtain a high score in a similar test in history. The popular belief to the contrary can be traced to two sources: (1) Whenever there are exceptions they are likely to be more noticeable than commonplace occurrences, and may be interpreted as types rather than exceptions. (2) People rationalize along lines giving them the greatest degree of satisfaction. "If a brother's child excels our child so clearly in history, there surely is some subject in which our child is superior." Such a conclusion is based on pure prejudice such as Sir Walter Scott had in mind when he wrote the introduction to *Ivanhoe*: "The public are in general very ready to adopt the opinion, that he who has pleased them in one particular mode of composition is, by means of that very talent, rendered incapable of venturing upon other subjects . . . But . . . the same capacity which carries a man to popularity in one department will obtain for him success in another."

Two lines of investigation relate to the question of inheritance as opposed to the acquirement of general ability; (1) studies

of mentality of twins and siblings; and (2) researches on the constancy of the I. Q. It has been found that twins are very much more likely to resemble each other mentally than siblings, who are not twins. There may be a tendency to explain this similarity by the exceptional identity of home environment, but researches such as those of Galton, Thorndike, and others show that young twins are not less similar than old ones. If home environment were the cause of similarity one might expect that twins having been separated shortly after birth would become mentally more dissimilar, but no evidence seems available to justify such suspicion. Galton's data show no such tendency.

Dr. Gordon¹ measured the intelligence of over two hundred pairs of siblings all of whom lived for ten years or more in three orphanages of California. These orphanages could not tend to make brother and sister resemble each other any more than it could cause, by similar environment, other inmates to be more similar. But the siblings showed strong similarity with a correlation of .52, practically the same as that found among home-dwelling siblings. Similarity caused by environment before leaving home seems unlikely in view of their ten years of orphanage life.

Psychologists have generally believed in a reasonably constant intelligence quotient.² This does not mean that there is an absolute unvarying constancy, but that it is very much more the rule than the exception. Conclusions are based on successive measurements of a large number of children over periods as long as seven years, the average change reported being about $\pm .05$ I. Q. Even this amount of variability may be due to errors in testing, unconscious differences in procedure, or to differences in the physical condition and attitude of the subjects. All of these may have entered the situation and would

¹ Reported by Elderton, Ethel M., *Biometrika*, XIV, pp. 379-408. March, 1923.

² The intelligence quotient is found by dividing the mental age in months by the chronological age in months.

be expected to cause more than the indicated I. Q. difference found on retesting.¹

More recent investigations show a wider divergence of the I. Q. on successive tests. Matthew and Luckey² report that twenty-four per cent of the cases showed a divergence of more than seven points of I. Q. between the first and second test. Of 38 cases with I. Q.'s between 70 and 90, 21 showed an alteration of from 11 to 30 points of I. Q. on retest. Various factors may operate to cause apparent differences in I. Q. Those factors which seem prominently concerned are: (1) linguistic difficulties; (2) psychopathic tendencies; (3) medical and health problems; and (4) behavior problems. As one or more of such factors may be operative to a greater or less degree, a reliably accurate measure of the I. Q. cannot be obtained.

Slocombe³ refers to three factors that enter into the repetition of tests: (1) the general intelligence which the test attempts to measure; (2) accidental errors or factors specific to each occasion of testing; and (3) factors which are common to a number of tests but not to all. The measurement in earlier years is of intelligence plus some factor or group of factors (apart from the specific factors which cannot be eliminated). The measurement in later years is of intelligence plus some factor or group of factors differing from that one or those present in the early tests. This being true, the conclusions drawn from comparison of scores at different ages is invalidated by the fact that the same thing is not measured at the different ages. While the test scores do not differ widely they do not furnish actual proof of the constancy of the intelligence quotient. Such constancy has only been inferred from the face value of the test scores.

¹ For evidence favorable to the constancy of the I. Q. the reader is referred to Terman. *The Measurement of Intelligence in Children*. And to Skinner, Gast, and Skinner, *Readings in Educational Psychology*, pp. 158-169.

² *Twenty-Seventh Year Book*, National Society for the Study of Education, Chap. XX. Bloomington, Illinois, Public School Publishing Co., 1928.

³ Slocombe, C. S., "Why the I. Q. Is Not Constant." *Journal of Educational Psychology*, Vol. XVIII, No. 6, September, 1927.

At this point the reader is warned of the pitfall in attempting to compare I. Q.'s obtained from the use of different mental measures. Mental ages and obtained I. Q.'s are significant only as the measure by which they were obtained is known.

The amount of general intelligence one possesses is often estimated by the social success he has achieved. It should be kept in mind, however, that success as measured by society is largely predetermined by the chosen field of endeavor. Of two brothers with equivalent ability, if one should engage in agriculture while the other were to become a newspaper man, the chances of the former's name to appear in *Who's Who* in comparison with those of the latter would be as 1 to 5380.¹

Nor should it be inferred that the high I. Q. will ensure success. At least three essential factors — ability, application, and previous experience — contribute to success. The relative influence of each of these factors varies according to circumstances. Professor Pyle² doubts that ability contributes more than one-half to achievement. "Genius achieves nothing without work. On the other hand, work achieves little without ability."

It is not at all certain that educators should be so seriously concerned about the amount of general intelligence so long as the individual has ability enough to progress normally. Society is not concerned with native intelligence as such; but with the social changes that education can cause. There seems then no good reason for the anxiety on the part of the psychologist. Educational procedure should be in harmony with the ability of pupils; but such procedure, while psychological, might have unsocial ends. If so, the educative process would be an unfortunate waste of human energy and of public funds.

The Influence of Education on Intelligence. One of Binet's criteria as a basis for his famous test was that the test should consist of "pick-up" material, or material which a child would learn apart from school training. But Professor Thom-

¹ Skinner, Gast, and Skinner, *Readings in Educational Psychology*, pp.127-128.

² *Ibid.*, p. 195.

son¹ reports an experimental study of Mr. Cyril Burt in which the latter finds that half the Binet mental age B is made up of school training. Mr. Burt used his own reasoning test I and refers to the school age S and chronological age A . By seemingly valid mathematical calculations employing partial correlations, he shows that on the average

$$B = .54 S + .33 I + .11 A$$

"Only to an extent of about one-half does performance in the Binet-Simon tests depend on schooling." Schooling, of course, may be distinguished from education, but Burt does not seem to differentiate clearly between these terms.

In measuring children in both urban and rural sections, not alone with the Binet, but with modern group measures such as the Gast Auditory² it is found that the average I. Q. of rural children is somewhat lower than for urban children. Whether this difference is due to actual difference in native intelligence or in quality of training, is uncertain. At least part of the difference is probably due to the attraction of urban communities for the more imaginative and mentally alert. This tendency may be somewhat limited to rural communities not very remote from the cities; and at greater distances native intelligence may be on a higher plane. The writer found many colored children in rural Missouri (1924) with I. Q.'s considerably above that of the average urban children. Professor Thomson found in the urban region of Northumberland 1 in 96 with an I. Q. over 130; while outside the urban region the proportion fell to 1 in 231, to rise again in the hills to 1 in 95.³

There is no doubt as to the part played by training in affecting higher scores in the various mental tests. Pupils whose training includes speed tests of various sorts secure much higher scores when taking mental tests and vice versa. Test results,

¹ Thomson, *Instinct, Intelligence, and Character*, Chap. XXI.

² Skinner, Gast, and Skinner, *Readings in Educational Psychology*, pp. 219-238.

³ Thomson, G. H., *British Journal of Psychology*, Vol. XII, p. 20, 1922, and Duff and Thomson, *British Journal of Psychology*, Vol. XIII, p. 192, 1923.

then, do involve the kind and quality of training; but one should not infer from this statement that higher resultant scores are indicative of greater intelligence.

Native Capacity and Training. Thurstone says: "For administrative purposes we do not need to measure pure intelligence."¹ Haggerty writes: "Intelligence is descriptive of behavior and not of static component parts of the 'mind': Because of original differences in native capacity, the same environment affects differently different persons."² Henmon writes: "Intelligence, then, involves two factors, the capacity for knowledge and the knowledge possessed."³ This idea is basic in his definition of intelligence.

It is often argued that intelligence tests measure training rather than intelligence; but Colvin reminds us that even the ability for sustained and logical thinking is the result of training. "Mental testing rests on the fundamental assumption that those tested have had a common opportunity to learn the skills, facts, principles, and methods of procedure exemplified in the tests."⁴

One is limited in obtaining a higher score because of training, either undesirable or special. As intellectual development nears its final limit, special education, often of a technical nature, begins. Such training cannot be used as a measure of general intelligence. It will appear later that even graduate university students do not stand higher in general intelligence than the best students in a ninth or tenth grade, and are often inferior. For practical measurement there seems little need for differentiation.

Does education tend to increase native capacity? "By capacity we may mean . . . the functional possibilities of the neural or other mechanisms which result in a degree of ability

¹ Thurstone, L. L., in "Intelligence and Its Measurement," p. 205.

² Haggerty, M. E., in "Intelligence and Its Measurement," pp. 212-216.

³ Henmon, V. A. C., in "Intelligence and Its Measurement," pp. 195-196.

⁴ Colvin, Stephen S., in "Intelligence and Its Measurement," pp. 137-138.

without highly special or intensive practice." ¹ One's ability in any intellectual task, according to Dr. Gates, depends upon his native capacity and upon acquired information and skill which may influence his performance. The effect of education is not to change directly or to modify the growth of native capacity. There is no evidence that training will produce stable improvement. In fact, education is not intended to increase native capacity, but to develop the information and skills needed by each particular type of task and individual. ²

The Influence of Specialized Training. Tasks not ordinarily learned by children of a given mental level can be learned if intensive measures are used to teach them. Miss Green concludes that the effect of coaching children in the tests of the Stanford Revision of the Binet Scale will appear in the results of later tests for an extended period of time. In her study no child was coached for more than two hours. "If so little coaching can produce so great an effect, it behooves those who are interested in the exact determination of mental ability to seek always for tests which will not be largely influenced by specialized experiences in the lives of some children." ³

The Limit of Growth of Intelligence. A problem of greater controversial importance is the limit to which native intelligence can improve. Among American authorities there has been a recent tendency to lower the possible limit from sixteen to fourteen years. On the other hand the Otis Advanced Test, with a possible score of 230, shows an increase in the average score to the age of eighteen years. It may be that the limit is not set by growth of intelligence, but by the possible attainment of speed. In most tests there is no provision for the control of speed although rather definite time limits are determined.

¹ Gates, A. I., "The Nature and Limit of Improvement Due to Training," *Twenty-Seventh Year Book of the National Society for the Study of Education*, Chap. XXIII, p. 458. Bloomington, Illinois, Public School Publishing Co., 1928.

² The terms *native capacity*, *training*, and *education*, should be differentiated.

³ *Twenty-Seventh Year Book of the National Society for the Study of Education*, Chap. XXI. Bloomington, Illinois, Public School Publishing Co., 1928.

It is possible that, by their very nature, the type of tests now largely used makes fourteen years the apparent limit of mental growth. This was certainly true of the Army Alpha. Norms are in terms of averages for each chronological age. If tests could be devised and standardized which would give a fair chance to the superior intellects in abstract thinking, it is probable that such mental mechanisms would be found developing for years beyond the sixteen-year limit. Superior adults can certainly do more difficult thinking than is permitted them at the age of sixteen with present measures. It may not be a mere coincidence that the accepted age for the cessation of intellectual growth is approximately that at which schooling commonly ceases. If on higher levels of intelligence, growth continues longer than at lower levels, our present practice of using sixteen years or 192 months as the divisor for all people having arrived at that age greatly magnifies differences in intellect.

Recent History of Intelligence Measurement. Early in this century the aesthesiometer was devised to measure the skin sensitivity believed to be the key to mental acuteness, so that if a man was thick-skinned he was thick-headed as well. But such a relationship could not be established. McDougall and Rivers showed that sensory discrimination might mean just anything at all, either stupidity or intelligence. The aesthesiometer measured sensitivity but not sensibleness.

Ebbinghaus, in his scientific study, was the first to measure memory in its simplest form, by the use of nonsense syllables. Then appeared McDougall's dotting machine to test fatigue, attention, and accuracy of aim.

Next in order Binet and Simon published their first tests in 1905; and Burt began his psychological tests in England. Instruments and machines have gradually been relegated to the psychological laboratory, in the conviction that if intelligence is to be measured at all it must be measured directly. A scale was Binet's crowning glory. Besides his 1908 and 1911 revisions of this scale, eight other revisions have been made.

The World War created a situation requiring the extensive use of tests by which large groups could be measured mentally at one time. Such tests as the Army Alpha were partly based upon Binet. Since 1918 many standardized tests, both individual and group, have been devised. Their success has depended mainly upon three mathematical discoveries:

1. Age-performance (Binet 1857-1911)
2. The theory of normal distribution (Quetelet 1796-1874)
3. Doctrine of correlation (Galton) developed and elaborated by Professor Karl Pearson.

Underlying Conditions in Intelligence Measurement.

Although conditions for testing are comparatively favorable in schools, they are not uniform. Inequalities and distractions vary widely as between schools and even classrooms within a school. Some rooms are disturbed by city traffic; others not. Some have double, others single, seats and desks. Some buildings have sliding partitions; others have separate rooms.

Psychical conditions are likewise not uniform. To some children the situation of being examined gives varying degrees of satisfaction; to others varying degrees of annoyance. Many and various forces aside from intelligence affect the scores. Nor can the examiner's personality and the teacher's attitude be disregarded. Woodrow ¹ says: "The influence of the tester's personality cannot be entirely eliminated." Burt ² considers that a child's proficiency in a test is the complex resultant of a thousand intermingling factors. Besides the two essential items, intelligence inherited and age reached, a host of subsidiary conditions affect the score.

Haggerty calls attention to underlying conditions not often fully recognized. "Such verbal tests,³ however, have their

¹ Woodrow, *Brightness and Dullness in Children*, p. 39.

² Burt, *Mental and Scholastic Tests*, Memo. 2.

³ Tests are often classified as verbal and nonverbal. Verbal tests are those involving words. Most tests are of this kind. Both the content and the directions involve language difficulties regardless of whether the test is given in auditory or printed forms.

limitations in testing illiterate or partially illiterate adults and children, in testing children of pre-school years, and in testing such individuals as may find the most adequate expression of their intelligence through manual or other non verbal activities." ¹ When certain individuals have relatively low scores, the examiner must discover underlying language or other conditions which, aside from intelligence, militate against higher scores.

Thorndike ² states that all our measures assume that the individual tries as hard as he can to get a high score. But in general practice we rarely know the relation of any person's effort to his possible maximum effort.

The very nature of tests themselves should not be ignored. The Army Alpha, for instance, was intended for use with men, and is weighted slightly in their favor. Its extensive general use since the war must have been misleading where face value results were employed. Another test widely used is also weighted in favor of boys. Without recognition of this feature inexperienced examiners might conclude that boys are more intelligent than girls.

Reading in Intelligence Measurement. Burt ³ concludes that of all recognized psychological functions, voluntary attention is the essential factor of general intelligence. Wundt, ⁴ Binet ⁵ and many other authorities share this opinion. The question is raised, then, whether more voluntary attention is not required for a high score when a problem or situation is stated audibly but once, than where it is possible for subjects to have printed test forms before them. That ability to read and comprehend correlate highly with intelligence is admitted. Differences in scores obtained by various individuals, however,

¹ *Loc. cit.*, p. 215.

² Thorndike, "The Measurement of Intelligence: The Present Status."

³ Burt, Cyril, "Experimental Tests of General Intelligence." *British Journal of Psychology*, Vol. III, p. 167, December, 1909.

⁴ *Elemente der physiologischen Psychologie*, 6th. Ed. I, 278-286, 1908.

⁵ "Attention and Adaptation." *L'Année psychologique*, Vol. III, pp. 393-395, 1899.

might result from actual differences in intelligence, from differences in opportunity, or from differences in degrees of literacy regardless of opportunity.

Burt says:¹ "In every test in reading and above all in tests of comprehension, the defective ranks decidedly below his general plane of intelligence, even when intelligence is judged by a semi-linguistic scale like the Binet-Simon tests. His mental age for reading is but little over 80 or 85 per cent of his mental age for intelligence." Trabue² finds that intelligence and reading correlate .79.

Health and Intelligence Measurement. Thus far we have studied the subjects of intelligence and of its measurement entirely from the point of view of the psychologist. But another party, the sociologist, has to be considered. Through the availability of so-called intelligence tests, educators have been led to believe that they have been measuring native ability by the use of these measures. This conclusion is no doubt valid, but many other traits beside intelligence are involved in a test score. How brilliant a subject may be, when that brilliancy is permitted to function to its fullest extent, can scarcely be determined. An individual is measured as he is, not as he might respond if he had always been properly fed and cared for, and were in possession of more favorable attitudes and only such habits as are conducive to healthy living.

Just how far we have been measuring native intelligence is unknown. We have been measuring pupil responses to test situations, and even this measurement is highly justifiable as a means of determining about how well a pupil should respond to school situations under conditions both physical and environmental when being tested. Pupil responses are largely conditioned by his health habits and practices. When we sort pupils according to intelligence quotient we are probably sorting them as much on the basis of physical fitness as on that of intelligence.

¹ Burt, *Mental and Scholastic Tests*, p. 283.

² Trabue, *Measuring Results in Education*, Chap. XVIII, p. 401.

There is no more potent hindrance to progress in school than ill health and its essential cause — bad individual health practices, and school authorities will inevitably realize the economic waste from this cause alone. The place to begin the elimination of much of the slow progress and retardation is in the classroom. Teacher training must include subject matter and the necessary procedure essential to health under modern living conditions. The writer recently measured, in coöperation with the teacher, the health habits of a third grade group of forty-two pupils, using the Payne Health Scale.¹ This particular group had been selected as the poorest among eighty-six pupils of the same grade as determined by the Gast Auditory Scale for Group Measurement of General Intelligence.² The group had had no real school instruction in health.

Among the traits most carefully studied were: (1) food — variety and quantity; (2) cleanliness; (3) sleep; and (4) indications of health.

1. Of the forty-two children, two had come to school without breakfast; thirty-seven had coffee for breakfast; twenty-eight reported nothing for breakfast except coffee and cake, or rolls, or bread and butter. Only six had cooked cereal.

2. Ten pupils had brushed their teeth that morning. Seventeen had a toothbrush in common with other members of the family. Fifteen reported not having a toothbrush. Two were apparently already “sewed up” for the winter as they were not anticipating another tub bath before spring.

3. Fourteen children each slept in a bed with two or more other members of the family. Only three actually slept alone. Several reported no windows in their bedrooms.

4. Two children had teeth either perfect or in good repair. Six had already lost one or more first molars. Nine had one or more first molars decayed beyond repair.

Teachers ordinarily do not know the health habits of the

¹ Payne, *Education in Health*, pp. 229-243.

² Skinner, Gast, and Skinner, *Readings in Educational Psychology*, Chap. V.

children they teach, and do not realize the extent to which health conditions school work. This knowledge is absolutely essential for intelligent school procedure, and without it a recognition of individual differences in health practices is impossible.

Many of the undesirable habits affecting health are due to ignorance, especially in the home. Foreign parents may have been able to survive very well under rural or semirural European environment. On coming to this country they bring with them their family and individual living habits, many of which are very inadequate for an urban environment in the United States. Our Americanization schools teach foreigners to read and write English, but it is even more essential to teach them how to live in America. Children of native parents need similar adjustment.

The sociologist faces a real educational problem in teaching how to live efficiently and how to avoid accidents. People are not educated by being taught merely conventional subject matter. They should first of all be adapted to their environment. Through education they should become harmonious with their environment, not clash with it; they should be more able to maintain a livelihood; and as far as possible improve their environment. All this means that education is responsible for the improvement of individual and social behavior. This is the primary function of the school, and a school system should be measured first of all as to its achievement in these fundamentals. The schools have been quite willing to attribute retardation and slow progress of many children to heredity rather than assume responsibility for bringing about the necessary social changes. Without adequate health, children unquestionably fail to measure up to their possibilities.

But unhealthful conditions and practices are not found alone among pupils apparently with a lower I. Q. Causes of ill health and inadequate mental functioning are to a large extent found among children coming from the best homes, the correlation between family habits and intelligence as measured being only

.30 to .40. Just how well such pupils would respond to intelligence tests, if they were in the best possible physical condition, no one knows. Test norms are established by averaging the responses of a large number of pupils of a particular age or grade. These norms would be radically different if all pupils were in the best of health and in condition to reflect more nearly their actual native intelligence. Unfortunate individual health practices are the essential cause for the lower standard of "intelligence scores." It is conceivable that we have many less really infirm children and many more real geniuses than our "intelligence measures" indicate.

Criteria in Test Construction. So many criteria are offered by the many authorities that only the most essential can be included here.

It has been concluded that for practical purposes discrimination between native ability and training is not essential. However, to rely upon school subject matter as test material is obviously unwise. Terman¹ states: "The first task in the construction of an intelligence scale is to select tests which are really tests of intelligence, tests which are not too much influenced by age, home environment, or school instruction apart from native endowment."

In attempting to devise a scale, Binet made three assumptions stated approximately as follows:

1. In measuring intelligence, material used should not be weighted in favor of school training. We should use material such as all have had an equal opportunity to "pick up."
2. Those who "pick up" are brighter.
3. Other conditions being the same, those who have "picked up" more are more intelligent.

Thorndike² differentiates as between levels of intellectual material: "The power of good responses to abstract qualities and relations rather than gross total facts, and to ideas rather than

¹ Terman, *Stanford Revision, Binet-Simon Scale*, p. 129.

² Thorndike, E. L., in "Intelligence and Its Measurement," p. 124.

direct experience, may be called the more intellectual variety of intellect." Later he adds: "In measuring a person's general status in intelligence and in inferring therefrom what his rank in native intellectual capacity in general is, what we do is to test him with a fair sampling of data and operations."¹

Terman is more specific, saying: "But if intelligence is ability to think in terms of abstract ideas, we should expect the most successful intelligence tests to be just those which involve the use of language or other symbols. We should also be justified in demanding that an intelligence test should correlate well with what we may call 'school educability.' As a matter of fact it is precisely tests of this type which are surviving in the struggle for existence: tests involving arithmetical reasoning, language completion, naming opposites, matching proverbs, completing analogies, understanding different passages, etc. The list could of course be greatly extended, but all tests which are notably successful in measuring intellectual differences among adults have something in common with those named, even when they work with concrete materials instead of with words."² He also says: "However, even for children of eight or ten years, no purely non-verbal battery of tests yet devised is as successful as any one of the several existing batteries which make some demands upon the language factor."³

Quite in harmony with Thorndike, but in different terms, Colvin writes: "Since, however, general intelligence cannot be considered as a single unitary factor, but as a common average of many different factors positively, but by no means perfectly correlated, intelligence tests should explore as many aspects of human ability as possible . . . We need the simpler tests, tests involving specific knowledge of facts, memory, perception, and the like, but we need also, and in a greater degree, tests to measure the higher intellectual processes."⁴

¹ *Ibid.*, p. 125.

² Terman, L. M., in "Intelligence and Its Measurement," p. 129.

³ *Ibid.*, pp. 129-130.

⁴ Colvin, Stephen S., in "Intelligence and Its Measurement," pp. 137-138.

Pintner very wisely excludes from tests material of a higher educational nature and technical training. "We, therefore, need intelligence tests of all types, and by intelligence tests I mean tests of the general ability to do all sorts of things as opposed to educational and trade tests which are specifically made to measure the knowledge which an individual has been directly taught."¹

Haggerty adds: "The most satisfactory tests so far devised attempt to measure intelligence in its essential complexity. The earlier attempts to analyze the factors of intelligence into simple elements . . . largely resulted in failure to secure useful tests. Over-analysis apparently distorts the essential phenomena to be measured and to follow this path of experimentation is to court futility. The practically useful test must evaluate the capacities of an individual in the essential complexity necessary to meet actual living situations."²

In essential agreement with other authorities, Haggerty refers to the use of language. Of the successful tests thus far devised he says that the most dependable are tests of a knowledge of vocabulary, of general information, tests of facility in thinking logical relations such as opposites and analogies, for ability in the solution of arithmetic problems, in the completion of elliptical sentences, etc. "It is possible and probable that such verbal tests will always be the best and most generally useful means of testing the higher ranges of intelligence."

Types of Exercises. Exercises should call for relatively little writing. In order to have a test highly reliable it is necessary that the exercises call for responses which may be judged as either right or wrong by all competent persons.³

Any exercise not uniformly interpreted should be rejected. An exercise difficult to score should be omitted where possible. In constructing a power test, exercises are usually rejected

¹ Pintner, Rudolph, in "Intelligence and Its Measurement," pp. 140-141.

² Haggerty, M. E., in "Intelligence and Its Measurement," p. 214.

³ Monroe, DeVoss, and Kelly, *Educational Tests and Measurements*, p. 398.

which are not done correctly by a gradually increasing per cent of children from a lower to a higher school grade.¹

Kelly finds that verbal material is better than nonverbal material for measuring the kind of intelligence most essential to school success as our schools are now organized. The National Intelligence Tests were designed for use in classification of children, under conditions now obtaining, for grades three to eight. It is claimed that they are valuable for measuring progress in these grades.²

Group Tests. With the advent of the world war and the establishment of Psychological Service, it became necessary to devise a test that could be administered to large numbers at one time. The result was the Army Alpha and Army Beta Tests which were given to nearly 2,000,000 men. With the close of the war, the interest in tests of intelligence became widespread. Whereas the Binet-Simon Test and its several revisions could be given to only one individual at a time, the Army Tests and those that followed were so constructed that they could be given to several hundred simultaneously. Among these tests, the following have been very popular: The National Intelligence Tests, The Otis Tests, The Terman Group Tests, The Illinois Examination, and The Haggerty Tests.

Group test scores, especially when very low, should be verified by the use of various performance tests, e.g. the Goddard-Seguín Form Board Test, the Healy Tests, and the Knox Cube Test. Such tests are especially valuable when used with deaf or foreign children or with children having defective speech, since they are nonverbal in character.

The Intelligence Quotient. The degree of mental maturity of the individual, that is, his degree of brightness or dullness is best expressed in terms of a quotient that represents the relation between the chronological and the mental ages. This quo-

¹ *Ibid.*, p. 400.

² Franzen, Raymond, "Attempts at Test Validation." *Journal of Educational Research*, Vol. VI, p. 158, September, 1922.

tient is called the Intelligence Quotient or I. Q. It is obtained by dividing the mental age by the chronological age and multiplying the result by 100.¹ Thus a child with a mental age of seven years and a chronological age of seven, has an Intelligence Quotient of 100. A child of six years with a mental age of nine would have an I. Q. of 150; whereas another child of six with a mental age of four would have an I. Q. of only $66\frac{2}{3}$. When the quotient is below 100 (or 1.00) it denotes that the child is below the median or average score, and if it is above 100 (or 1.00) it denotes that the child is above the median or average score. Terman has given us a very satisfactory classification of intelligence quotients with their approximate meanings:

6%	I. Q. above 140.....	Near genius or genius
	I. Q. between 120 and 140..	Very superior intelligence
14%	I. Q. between 110— and 120.	Superior intelligence
60%	I. Q. between 90 and 110..	Average intelligence
14%	I. Q. between 80 and 90..	Dullness
5%	I. Q. between 70 and 80..	Borderline deficiency
1%	I. Q. below 70.....	Definite feeble-mindedness

Individuals having an I. Q. of less than 20 are administratively classified as idiots; those with I. Q.'s ranging from 20 to 50 are classified as imbeciles; and those with I. Q.'s between 50 and 70 are morons. According to this schedule, adult idiots would have a mentality not exceeding two years or three at the most; the imbeciles would range from two or three to seven years; and the adult morons would have mental ages ranging from seven to eleven year levels. While the intelligence quotient is not constant from year to year, it approximates a certain reasonable constancy — at least in most cases. This adds to its value for prediction purposes, especially as regards the rate of mental growth. If a child has an I. Q. of 100 it means that he has developed, is developing, and will continue to develop mentally

¹ Some testers do not multiply the result by 100. They simply express the I. Q. in terms of the decimal, as .40 or 1.50.

more or less constantly at the rate of the average or median child. If he has an I. Q. of 140, it means that his rate of mental growth greatly exceeds that of the average child. An I. Q. of 70 means that the rate is much slower than the average, with approximately one per cent developing less rapidly and ninety-nine per cent more rapidly. Consequently, the I. Q. expresses the degree of brightness or dullness of an individual.

What Do Intelligence Tests Measure? Intelligence tests were devised to measure native mental ability. Consequently, the test-makers have included such representative items as would be affected as little as possible by schooling or training. From studies that have been made, notably by Bagley,¹ we know: (1) that intelligence tests measure the educational opportunities of the individual as well as innate capacity; (2) that other qualities, than what is generally designated as intelligence, account in a large measure for one's success in life; (3) that it is probably advisable to recognize at least three kinds of intelligence: abstract, social, and mechanical; and (4) that some tests are not equally valid for all children under all conditions. Dr. Burt,² one of the greatest English test experts, believes that the gross result of intelligence tests indicate that one-ninth is attributable to age, one-third to intellectual development, and over one-half to school attainment. In determining the child's performance in the Binet-Simon Scale, Burt believes that intelligence can bestow but little more than one-half the share of school, and age but one-third the share of intelligence. Burt uses the term, however, to denote innate capacity. The tendency in America at present, is to use the term in a broader sense so as to include both original capacity and the acquired facility in using it. Therefore, the differences disclosed by the tests may not be due to differences in original capacity alone, as if education and environment were not factors at all; but often

¹ Bagley, W. C., "Educational Determinism." *Educational Administration and Supervision*, Vol. VIII, pp. 257-272, 1922.

² Burt, *Mental and Scholastic Tests*.

what they disclose is differences in educational opportunities. Native endowment is only one of several factors involved. We can avoid much of the widely prevalent misconception by classifying tests as measurements, not of native intelligence, but as tests of general ability or general tests of attainment.

It is probably unwise to draw a hard line between traits due to native intelligence and those due to education and environment, and it is equally objectionable for amateurs to attempt to demarcate traits of character due to heredity and those due to environment. It is even quite probable that human nature never can be reduced to a formula.

Uses of Intelligence Tests. Intelligence tests have been used to serve many and diverse purposes. Their use may be represented by a normal frequency surface. At one end of this "bell" curve they are well used; at the other end they are grossly misused. Between these extremes, they are used with little or no thought as to their significance. In brief, intelligence tests serve five important functions when properly administered and when the results are rationally interpreted and utilized.

1. They are useful in classifying children into more homogeneous¹ groups. They should never be used alone, however, for this purpose. Instead they should be supplemented with achievement tests, marks in school subjects, teachers' estimates, and ratings of the physical age, the social-moral age, the chronological age, and the child's health. Even when all these factors are taken into consideration, variations will exist in each group. Perfect homogeneous grouping is an impossibility. Moreover, variability, within limits, in each class is desirable.

2. Intelligence tests may be used as a means of diagnosing the capacity of pupils who fail to make satisfactory adjustments in and out of school. They may aid in the location of the difficulty. If the fundamental cause of the maladjustment is not the lack of general mental ability, other mental tests of

¹ It is not positively known what trait should be basic for homogeneity.

a specific nature may be used for further analysis. Or, again, the cause of the problem situation may not be due to any general or special disability; it may be found in lack of motivation, a poor start, or poor training. Mental tests can indicate only the extent to which the problem situation is caused by incapacity.

3. Intelligence and other mental tests are useful instruments for educational guidance. In the hands of a competent individual, they may indicate how long any given child can profitably remain in school. They also yield valuable data that should be considered in the selection of groups of courses, as to the advisability of leaving school to work, or of remaining in school, and possibly of going to college.

4. Intelligence and other mental tests may be used as aids in vocational guidance. Tests of general mental ability or intelligence may be used to determine for what vocations the individual has sufficient capacity to expect a reasonable degree of success. Tests of special ability, e.g. tests of musical talent, aim to determine whether the individual can measure up to the requirements of a particular vocation, other than the general requirement of intelligence. The results of both general and specific mental tests may yield valuable information concerning the selection, transfer, and promotion of employees.

5. Finally, tests of general and special mental ability may be used to determine the efficiency of educational units. This involves ascertaining the relationship between achievement and capacity. By assuming that tests of general mental ability measure native capacity, and that educational tests and scales measure the result of education and training, it follows that the relationship between the scores of these two type tests give us an index, though not a very reliable one, of individual or group efficiency. This ratio or index is known as the Achievement or Accomplishment Quotient or A. Q.

We are not justified in basing promotions of teachers on their degree of success in getting their classes up to an efficiency of

100. The validity of our tests is too uncertain, and the pupils' scores are influenced by too many factors to justify any such procedure. Moreover, in small school systems where the promotion or salary schedule is determined on this basis alone, teachers will work to get results of this more formal and measurable sort, and thus neglect the more important and more intangible marginal outcomes such as habits, attitudes, ideals, appreciations, and sentiments.

"The sociologist is not concerned with native intelligence as such, nor particularly with the results of intelligence tests as a basis for educational procedure. He feels that the emphasis of the testing movement has been to turn the attention of the educator away from the most desirable outcomes, and to cause him to proceed on unwarranted assumptions. Intelligence test results are not measures of native ability alone. They are measures of pupil responses to test situations, but are not necessarily measures of anything else in particular. Test results do indicate a composite quality of health, energy, ambition, training, and many other traits which aid or hinder successful achievement. We have tended to forget that the child has a personality as well as an intelligence, and that he has attitudes as well as abilities."¹

Reasons assigned for homogeneous grouping according to some social trait are essentially: (1) economy in learning; (2) improvement in educational procedure; (3) improvement in kind and quality of training; and (4) more adequate adaptation to pupil nature and needs. If educational practice were sufficiently standardized even within a particular school so that a pupil's mark would have specific meaning, and a grade reached would indicate definite social accomplishment, there would be little need for other than a standard age-grade table for pupil placement within a school grade. Pupils having completed five years of school work at the age of eleven years have a

¹ Gast, Ira M., *Journal of Educational Sociology*, Vol. I, No. 3, November, 1927.

composite homogeneity as a group far surpassing a group selected at random. The same is true of pupils older than eleven years who have just reached the sixth grade in school. Where school conditions permit of a sociological procedure, placing under-age and over-age pupils in the same group is unjustifiable.

1. Economy in Learning. Pupils should be given all the socially significant training that is possible within a given period of time. Superior learning technique and better habits, attitudes, and ideals should result from school procedure. There appears no justification for rushing better pupils through school in much less than the standard time nor for spending less money to educate the superior than the inferior.¹

2. Improvement in Educational Procedure. Pupils making normal progress in school and not failing in their work are on the whole healthier, and capable of more and better work per unit of time. It is important that an inventory be made of the health habits and practices, attitudes, knowledges, and skills, as a basis for more economic adjustment to the environment. This adjustment is both collective and individual. "There is a collective learning process as well as an individual learning process."²

3. Improvement in Kind and Quality of Training. For proper training the curriculum must provide for the creation of community changes and practices and for methods of discovering to what extent school instruction does affect such changes.³ Every educative situation set up by the course of study, method, measurement, or by virtue of the school and class organization should contribute to the improvement of individuals in their social relations. It is possible then, that even the teacher should be selected whose personality and culture satisfy most nearly the needs of the particular group.

¹ Holmes, Henry W., *Twenty-first Year Book of the National Society for the Study of Education*, Part II, p. 121.

² Elwood, C. A., "What is Educational Sociology?" *The Journal of Educational Sociology*, I, 27.

³ Payne, E. George, *The Journal of Educational Sociology*, I, 1, iv.

4. **Adaptation to Pupil Nature and Needs.** Cyril Burt¹ has ventured to suggest that the school may be responsible through wrong training for much of the antisocial behavior of society. The procedure of the classroom cannot be determined in terms of the learning process alone. Learning takes place in a social situation. In the classroom is a group of interacting personalities, the teacher being one of these.² Unfavorable social environment and antisocial influence must not be tolerated. It is essential then that harmony and homogeneity abound to the fullest extent if the school is to assume its proper function — the development of desirable habits and attitudes to accompany the acquisition of essential knowledge and skills.

Educational Suggestions. As was suggested above, the grouping of pupils into relatively homogeneous groups should not be done on the basis of mental test results alone. Such groupings can be effected best when the educator has the complete picture (mental, physical, social, moral, etc.) before him. Moreover, such classification of pupils does not alter the fact that instruction should be individualized. Studies made in Detroit and elsewhere prove conclusively that when provision is made for individual progress, children in each group move forward at rates which are very unlike. Professor Courtis of the University of Michigan believes that complete individualization of instruction, whenever knowledge and habit outcomes are sought, is the only adequate solution of the problem of adjustment to individual differences, and that grouping of pupils in whole or in part on the basis of intelligence test results is merely an expedient, not a final solution. Moreover, standard tests in the school subjects furnish ample proof that children do not fall into permanent natural ability groupings that can be taught as a class of homogeneous ability in all school branches.

¹ Burt, *The Young Delinquent*.

² Zorbaugh, Harvey W., "Research in Educational Sociology." *The Journal of Educational Sociology*, I, 20.

The question is often asked, should children be informed regarding their I. Q. The answer is in the negative. Only in very rare cases would one ever be justified in handing out such a grade. In all probability, the teacher should not know the mental ratings of her pupils. As a rule teachers do not interpret such ratings intelligently. They overemphasize and misunderstand. If no reputable psychologist would give the child a permanent mental rating after he had given the child a group test, certainly no teacher should judge a child completely on the basis of a single test. Since the best of our intelligence tests do not measure all children equally well, or the same children equally well on successive occasions, their interpretation should be left to the trained psychologist rather than to the teacher. The potential harm that may be done a child, if the teacher knows his I. Q., outweighs the good that can come from knowing such scores. Of course, when we get a well-trained teacher personnel, who fully realize that other traits than those measured by our present tests are about equally important, there will be no danger attached to the teacher's knowledge of the I. Q.'s of her pupils.

Every pupil is good for something and he must be conscious of this fact. No stigma should be attached to having a certain I. Q., being in the "C" section of a particular grade, or in being in an ungraded or opportunity class. Children of average mental ability may make genuine contributions if they possess good health, persistence, and industry.

Our schools are trying various plans for adapting instruction to the children's needs. In some schools, the brighter pupils are given an enriched curriculum, the duller children the minimum essentials, and the average children, the regular school work. In other systems, the materials of instruction are relatively constant, but the time that the pupils stay in a given grade varies according to the intelligence of the group. The brighter pupils may finish what is a year's work for the child of average ability in seven months, whereas the duller child may require

thirteen months for that grade. In some schools, skipping of a grade or half-grade by the brighter pupils, and the repeating of a grade or part of a grade by others, is permitted. In still other systems, little or no attention is paid to classification of pupils and grade promotions, since each child is free to advance individually just as rapidly as he is able.

Questions and Problems

1. Can intelligence be defined? How would you define intelligence?
2. If we do not know exactly what intelligence is, how can it be measured?
3. What do intelligence tests measure? achievement tests? Do they measure about the same thing? Why or why not?
4. What abilities are we able to measure? Does the aggregate of these abilities constitute an exact measure of intelligence?
5. Does an intelligence test measure personality, ambition, and one's ability to adjust himself to his environment?
6. Can intelligence test results serve as the basis for the classification of children into homogeneous groups? If not, what other factors should be considered?
7. What factors contribute to success in school subjects? Can they all be measured?
8. Define each of the following: chronological age, intelligence quotient, mental age, physiological age, reading age, accomplishment quotient.
9. Does the intelligence quotient (I. Q.) remain the same? If not, what factors would cause it to change?
10. If children are grouped into sections A, B, C, etc., according to intelligence, should there be any failures in the A group, the B group, or the C group? Why or why not?
11. How should the superior and the inferior child be treated in a school system where classification according to intelligence is prohibitive on account of administrative difficulties?
12. Can the I. Q. serve as a basis for the classification of school children? Why or why not?
13. What were the contributions of Binet and Seguin to the intelligence testing movement?
14. Upon what factors should promotion be based?

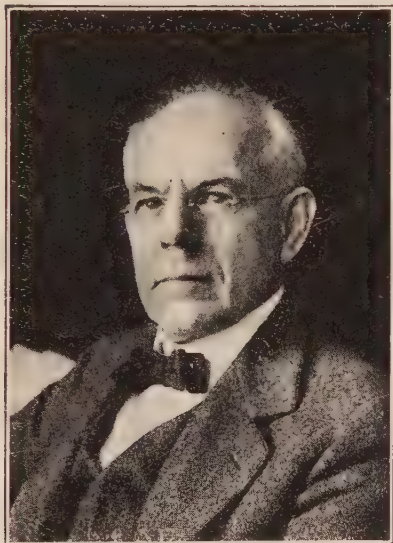
15. What are diagnostic tests? Of what value are diagnostic tests?
16. Outline a testing program for the upper grades. Indicate how you would use the results.
17. What pupils are usually promoted too rapidly for their ability? What pupils too slowly for their ability?
18. What factors frequently operate to cause an underestimation or an overestimation of one's intelligence?
19. Show how the various ages mentioned in the chapter are of value in diagnostic and remedial work.
20. Make a list of the authorities on intelligence and intelligence tests.
21. Thorndike mentions three kinds of intelligence: abstract, social, and mechanical. Does the representative intelligence test measure these three kinds of intelligence? Explain.
22. Give the formula for finding each of the following: I. Q., A. Q., M. A., and R. Q. Illustrate each by an actual problem.

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J. McKeen Cattell

CHAPTER IV

CHILDHOOD AND ADOLESCENCE

Physical Growth and Development. Problems of growth are largely individual problems.¹ Individual curves and profiles give the best pictures of growth and development. It is only within recent years that consecutive measurements of the same groups of children have been made to find out how children actually do grow physically. Any standards that are based upon measurements of different groups of children are both inaccurate and inadequate.

The weight-height relationship is the most practical index of the physical status of the child. Intelligent use of the Baldwin-Wood weight-height-age table will enable teachers and parents to determine with fair accuracy the child's physical condition, since normal growth in weight and height is probably the best single index of good health and good nutrition.

In addition to a chronological age, a mental age, a social-moral age, an educational age, and a pedagogical age, the child has an anatomical and physiological age which is indicative of physical development and anatomical and physical maturity. This physiological age is determined by such characteristics as the eruption of the teeth, presence of permanent teeth, bones in the wrist, height, changes in the voice, and onset of adolescence.

In general the physically better developed children are older physiologically than the underdeveloped children. There is also a close correlation between physiological and mental development. The advantage of early pubescence is probably

¹ Baldwin and Stecher, *Psychology of the Pre-School Child*.

only a temporary one.¹ Pubescence² is accompanied by a spurt in mental development in the case of those who mature early, and the effects of pubescence, whether early or late, appears to be equalized in adult life.

On the whole, human growth and development is continuous and gradual. This rule applies to anatomical, physiological, and mental development. The rate of development and growth may be accelerated or retarded within limits by such factors as climate, nutrition, health, and exercise; but the tendency is for the individual to develop and grow gradually and regularly until maturity. Infancy, childhood, and adolescence are but stages in the continuous process of growth. The stages overlap. For example, adolescence may begin any time between eleven and sixteen in girls and between twelve and seventeen in boys. Its onset is affected by many factors such as climate, race, sex, and physiological age. The stages in social-moral and emotional development are more marked.

In the following discussion of periods of development, the characteristics of the several stages are somewhat exaggerated. Let it be emphasized that there are no hard and fast periods and no exact boundaries. Growth is gradual and continuous; but individual children may vary greatly. Some enter a given stage earlier, and pass through it more rapidly than others.

Development of the Child's Mind. The first six years of the child's life are of greatest importance. At birth, there is only a very vaguely conscious mind. The new-born infant is supplied with over nine billion undeveloped and partially developed neurones. Not many of the neurones are developed by prenatal influences; and even these are only of the lower reflexes. All nerve cells and their organization must be developed by exercise.

The doubling of the brain's weight during the first year after

¹ This statement is based upon a paper, "Pubescence and Mental Development," by Dr. Morris S. Viteles, read before the American Psychological Association, at Philadelphia, December 29, 1926.

² Pubescence, the arrival of puberty.

birth and its treblings during the first four or five years are products of the influences of the functional exercise of the neurones. The exercise of these neurones is possible only as a result of stimulations from nerve impulses set up in the sense organs.

The child's mind at birth is a "reflex mind." It lacks awareness of any great degree. It is, as James says, a "big buzzing confusion." A child's activities are the "random movements" of the voluntary muscles of limbs and body. From these movements habits are established. The reflexes are conditioned. Instinctive tendencies are blending with other instinctive, habitual, and volitional activities. The child goes through a process of many trials and errors and a few successes. His habits, his trials, his errors and successes, his memory and imagination, and his cravings and urges give him a basis for comparisons and for the formation of judgments. He gradually acquires the ability to reason and to profit from experience. He learns to inhibit certain tendencies and to make conscious choice.

The mind of the infant is a mind of possibilities and potentialities. It has a biological heritage of tropisms, reflexes, instinctive tendencies, and capacity to learn. The infant is born into a society of customs, traditions, and culture, which become an important part of its environment. To this environment he reacts, and his responses are the basis for his development.

Importance of Play. Exercise promotes development. Play is the most quantitative and diversified of all forms of exercise. It stimulates the undeveloped and developing nervous system, and thus develops the mind or higher forms of behavior. The period before the age of six is the one in which the exercise of connecting and reacting mechanisms may be most productive educationally. The play life of this period is spontaneous, imitative, and varied. The games and plays are full of action. The child plays either alone or with others but his enjoyment is always self-centered. The infant's so-called

play is at first a matter of senses and muscles. He soon learns to like anything that has a rhythmical tendency. At about the age of three he becomes interested in plays that involve memory and imagination. This is shown in imaginative and dramatic activities. There is as yet neither rivalry nor teamwork in his play activities. Coördination of body parts and the attending development of the higher levels of behavior, result from play activities.

The Child's Curiosity. The child is eagerly seeking after information. He asks "How?" "Why?" and "What for?" He is intensely curious at first regarding his sensory experiences, and then about the relation between things. As a rule, the child should be allowed to sense only those things that will improve his behavior.

The Young Child's Imagination. The young child is intensively imaginative. He may personify many of his experiences. He likes fairy tales and lives in a world of make-believe. He makes no clear distinction between the imaginary and the real. The confusion between fact and fancy accounts for many so-called lies of children. He is very credulous and suggestible. He will believe anything told him because his limited background of experience is an inadequate basis for discerning truth. He imitates single actions rather than people. He wants to act like the people he admires. He is *self-centered*. This is "mine" and that is "mine" is perfectly natural.

The Pre-School Period. The pre-school period is biologically the most important period in the development of an individual because it comes first. It inevitably influences all subsequent development. These years determine character to a large degree. The laws of growth and development make these the most formative of all years. The younger the child the more rapid its relative growth. The mental growth which takes place during the first six years far exceeds that of any subsequent period.

The Transition Stage. The period from six to eight is a

progressive transition from the earlier period. His plays now become more purposeful and controlled, and take on the form of games. He is no longer content to play alone. He prefers companions. Rivalry and competition begin. The child is just as eager for sense experiences. These he interprets in the light of his meager experience. He wants what some other child has although he may have something more valuable in his hands. He has better control of his imagination, and is able to distinguish between fact and fancy. He is able to grasp relations, make comparisons, and put facts together into a connected whole. He likes to be with other children, but has not learned to coöperate with others for the good of the group. He has learned to imitate the person he admires, rather than that person's deeds. He likes animals as playthings, wants to know where he can obtain a pet, and whether it will bite him. This is a period of social companionships where important lessons in "give and take" are learned.

The Formative Period. The period from nine to twelve has been called the formative stage. It is a period of individualism and self-assertion. His interests are varied. His pockets have been likened to traveling museums. He is fond of collecting, exploring, and adventure. During this period the sexes have few interests in common. Social motives predominate in games which are competitive in nature. He learns to coöperate with others and to do teamwork. However, he misunderstands adults and they often misunderstand him. The child is impulsive, eager to experiment, and to try out. His senses of ownership and of honor are not yet well developed. This period has been called the age of hero-worship. The boy idealizes men who do things, men who achieve; while girls may idealize either men or women. The hunger for books and reading increases and is often almost insatiable. It is important that plenty of books and magazines be placed about him, of the kind that seem good both to the child and to the adult. They should be neither preachy nor moralizing. There

should be no *forbidden* lists. What boy does not like to do that which is forbidden?

The ideal leader of this age is one who enters into the child's activities with interest and zest; who wisely directs but does not dominate; who is able to out-jump and out-distance those in his group; who has many stories to tell; who is firm in his exactions; who has an inspiring personality and can be approached by the child with full confidence of being understood and of having his contribution appreciated.¹

Adolescence. The transition from childhood to adolescence is definite and natural. Adolescence begins at that moment in the physiological development at which an individual first becomes capable of procreating. As a rule this stage is reached by girls in their twelfth or thirteenth year and by boys in the fourteenth year, the early years of adolescence being called *puberty*. Adolescence ends at maturity or about the age of twenty-three to twenty-five.

Dr. Cox² has made a very excellent review of the facts showing that the dawn of adolescence is a period of very complex biological and social adjustments. He writes: "Puberty is accompanied by many rather obvious phenomena such as rapid increases in height and weight, changes in facial contour, physical gawkinsness due to uneven growths of bones, tendons, and muscles, and the development of primary sex organs and secondary sex characteristics. There are important changes in the child's circulation; increased blood pressure puts a severe strain upon the heart to perform its added duties. There is a change in pitch and quality of the voice, more marked in boys than in girls.

"These developmental characteristics must be thought of in the light of the increasing sex consciousness, sex interests, and sex-suppressions which evolve from the interactions of the

¹ Hall, *Adolescence*.

² Cox, Philip W. L., "Behavior-Adjustments and the Junior High School Curriculum." *Journal of Educational Sociology*, Vol. I, pp. 37-38. September, 1927.

child's nature and the social mores and taboos. The child's social awareness which accompanies the maturation is partly a result and partly a cause of his identification of himself with adulthood. The behavior-adjustments to the social practices and attitudes of the adult world complicate and are complicated by the organic changes that are taking place within the unbelievably complex mechanism—the individual boy or girl.

"The human body is made up of thousands of billions of individual cells, each one of which is born, lives, breathes, feeds, excretes, produces, dies, and is succeeded by its offspring.

"Each of these individuals harmonizes 'with its own inner life some special function for the benefit of the whole, and destined ultimately for an individual death. Day-long, night-long, in this commonwealth that constitutes each one of us, there goes forward as in the body politic the subservience of many individual purposes to one, the sacrifice of individual lives for the advantage of the many, and the birth of new units which replace the dead . . . And each of these living commonwealths began its individual existence as a single unit, whence arose the myriads that compose its adult being. There comes thus to co-exist the lime-hardened tissues of our bones, the contractile cells of our muscles, the conductive cells of our nerves, and so forth.'¹

"Obviously there must be some plan by which these many congeries or communities of cells develop and function for the welfare of the human being of which they are a part. Somehow or other the communities are stirred into action in response to some stimulus, and so food digests, hearts beat, lungs breathe, sex organs mature and function, wounds heal. One set or another of cells multiplies more rapidly than usual and after a while returns to its normal rate.

"The control of growth and of special functioning is largely vested in the endocrine or ductless glands. These glands se-

¹Quoting Sherrington, *The Integrative Action of the Nervous System*, pp. 67-68.

crete *hormones* or *autacoids* which enter the blood stream and stimulate into activity the communities of cells or organs which the particular hormones affect.

"The primary physical and mental changes that take place at adolescence are chiefly due to the activity of an autacoid secreted by the cells of Leydid, so-called 'interstitial cells' in the gonads (testes and ovaries). But other glands have important parts to play in this phenomenon as well. If the thyroid does not function normally, causing the disease *myxodema*, the characteristic development of adolescence does not take place. The same failure of normal adolescent development happens if the pituitary gland or the pineal gland (two glands found just under the brain) or the adrenal glands (situated on the kidneys) do not function as they should. The thymus gland, found in the neck below the larynx, generally atrophies at adolescence. If it does not so atrophy, the boy is effeminate and has the high voice characteristic of girls and little children. It is less directly connected to the sex organs of girls, while the thyroid gland is more closely related to sex functions of girls than of boys."

Early adolescence is a period of *expansion*. The youth becomes possessed of a new sense of power and importance which culminates in an interest in the problems of humanity. This expression of independence often resolves itself in a desire to go to work or to make one's own way.

Early adolescence is intensely idealistic. The boy is more than a hero-worshiper and imitator. He begins to find himself, and to sense the problems of the world that await solution. He recognizes social values. The gang tendency that was strongest at thirteen finds expression in boy and girl scout activities. The youth is altruistic. He is willing to pursue ideals for the sake of others. He cares more for the approval of his fellows and recognizes the wider influences of coöperative action. During the formative period boys and girls held themselves apart. Their interests were different. But relatively

early in the adolescent period, boys begin to pay attention to their dress and girls are no longer "tomboys." Each sex becomes interested in the other. At first the feelings of affection for the other sex are not stabilized. They are mere passing affairs. The feelings deepen and become more stable until the early twenties, when life partners are often chosen. It is also in the period from fourteen to nineteen that most of the religious awakenings or conversions occur.

The adolescent becomes a better thinker with the passing of years. He tries to understand but is critical. He hesitates to accept statements on someone else's authority. He wants to know the reasons. His doubts are omens of good if he is properly guided in his search for truth.

While early adolescence is marked with a sort of instability and poor muscular coördination due to self-consciousness, it is easy for him to emerge feeling a certain confidence in himself and in his power to achieve.

Today the world is hearing much of the *youth movement*. Youth is in revolt against forms of slavery forced upon them by their elders. They are idealistic and interested in all humanity. Their ideals are generally right, although their methods may be impractical.

Not all youths who are concerned with social welfare are idealists. Many of the criminals of today are youths from sixteen to twenty-five. Each reflects the environment and the ideals of his home and community. All are victims of environment and associations.

Questions and Problems

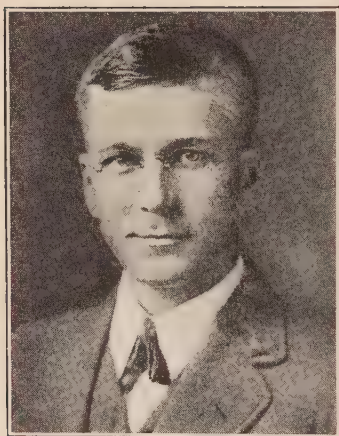
1. Name and define seven different ages which may be employed in measuring an individual.
2. What are the advantages of early pubescence?
3. In what respects are the first six years of a child's life of great importance?
4. For what specific reasons should a child be provided with a variety of play activities and ample recreation?

5. Distinguish between a young child's imagination and his memory.
6. Of what importance is the pre-school period educationally?
7. Describe the play tendencies in each of four periods of the child's development.
8. In what respects do childhood and adolescence differ? Classify these differences under several headings.
9. Trace the effects of specific childhood training upon adolescent behavior.
10. What factors are involved in the promotion of delinquent tendencies?
11. Justify your reaction to the statement that every community has the criminals it deserves.
12. Account for the fact that particular psychological and social tendencies are locally geographical.

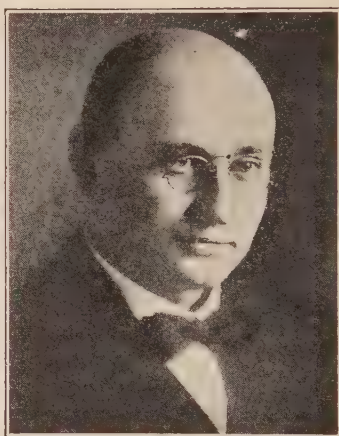
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Arnold Gesell



Harry L. Hollingworth

CHAPTER V

THE GIFTED CHILD

Environmental Influences in Individual Development.

That two forces, nature and nurture, unite in determining human achievement is unquestioned. The problem of nature or heredity has been presented in another chapter and a discussion of the old question of supremacy of these two forces is not sufficiently related to our problem to be discussed here. Whatever one's physical inheritance, while not subject to change, it may be the cause of many perplexing problems in education. The real field of possibility for the individual, however, is his nurture or training and adaptation.

Professor Clarke ¹ recognizes the importance of nine environmental conditions as determining factors in human achievement: (1) social environment; (2) geographical environment; (3) local environment; (4) education; (5) economic condition of the individual; (6) father's occupation; (7) occupation of the individual; (8) religious training; and (9) rank in order of birth within the family. To these environmental factors in determining the extent to which an individual may be credited with achievement, Professor Ellwood ² contributes certain other factors: (1) the stimulation of the social environment; (2) readiness of society to recognize achievement and to use it.

All ranks of society have produced men and women of recognized ability. Much of this ability has been found within certain families, but neither a select group of families nor a particular national strain has had the monopoly. It appears,

¹ Clarke, *American Men of Letters*.

² Ellwood, *Psychology of Human Society*, p. 335.

for instance, that the relative number of literati born in the United States increased rapidly from 1775 to 1820. Between 1821 and 1830 less than sixty per cent as many were produced as during the previous decade. The decline continued steadily until, during the last decade, the number born was less than thirty per cent of the number produced during 1811-1820. "Authors of the first rank disappeared after the civil war because their work seems to have been no longer appreciated.¹ In other words, the social environment had become relatively unfavorable to literary activity.² In the light of recent studies it is reasonable to assume that people of talent of whatever kind, such as in literature, are more dependent upon environmental factors than people not so recognized, being endowed with finer sensibilities.

"It appears that the northern states have produced more persons of talent than have those of the south."³ But the classification of men of letters by decade and state of birth shows that the relative importance of the states was not constant, nor are the exact causes for the change apparent. The center of American literary activity was gradually shifting during the later decades. New England's lead had been appreciably reduced. During the entire period, 1771-1850, there were great differences in the literary productivity of different sections of the country; but at the same time there is no evidence of great diversity of population elements found in the several states, nor that there existed any considerable difference in innate ability.

It appears that some of the older cities of New England, such as Portland, Portsmouth, Newburyport, Salem, Boston, Hartford, and New Haven, ranked high; and that other northern cities, such as Lowell, Lynn, Cincinnati, Newark, Brooklyn, and

¹ It must be kept in mind that probably the period of greatest productivity of an author is normally between forty and sixty years after his birth. Thus, the literary birth rate of a period is roughly noted by the amount of literary activity half a century later. The marked fall in birth rate of literati took place perhaps fifty years before the corresponding decline in literature.

² Clarke, *American Men of Letters*, p. 40.

³ *Ibid.*, p. 54.

Pittsburgh, ranked low. Were these differences due to relative educational advantages? Professor Thorndike points out the danger of such an assumption. "That cities give birth to an undue proportion of great men does not in the least prove that city life made them great; it may prove that cities attract and retain great men, whose sons are thus city born."¹ It is apparent, however, that cities which before 1851 ranked high in men of letters did possess superior educational opportunities.

During the period 1771 to 1850 there were 506 college graduates who became famous in the literary field as compared with 133 who had completed a secondary course of study. But such figures do not settle the matter. A noted educator in a recent address referred to such men as Thomas A. Edison and Henry Ford as examples of men who have not been encumbered by the water-tight compartments of college training. Such a suggestion is not a valid criticism of college training. The fact that college graduates are in the majority among eminent people may show merely that people of such abilities, with their accompanying economic and environmental conditions, were more likely to graduate from college, rather than that the college is an essential contributing factor to success.

The reason for sex preference among eminent people at various periods may be questioned. In part the difference may be due to inadequate education available for women, and in part to other social conditions, such as attitudes and ideals of a particular period being more favorable to the recognition of talent in men. Very few women, born even as late as 1850, enjoyed a college education.

The economic status of parents is a most potent factor in determining the future success of children. Those children born to parents not poor seem to have about four times the probability for achievement recognition of those of the economically poor. Poverty of parents is by no means evidence of

¹ Thorndike, E. L., "A Psychologist's Theory of Education." *The Bookman*, Vol. XXIV, p. 290.

lack of ability on the part of the children. Even if assumed that the poor are indigent because of lack of energy or ability, it does not follow that all their children are deficient in these qualities. This being true, it is reasonable to suppose that poor children having to remain largely uneducated, considerable innate ability may remain undeveloped, and the genius remain hidden in the humblest environment.¹

Closely related to educational opportunity is the father's occupation. For the period studied, the farmer group seemed to produce the largest number of men of letters. But with changing conditions it is certain that this occupation would not prove favorable at present. As will be shown later the economic condition of the father is related to his occupation and thus to the educational possibilities of the child. It is apparent that birth into one of the so-called higher social classes gives the aspirant exceptional opportunity. Parents themselves being well educated, simple association with them is an education in itself. Such birth secures relatively easy entrance into educated circles and has a great advantage in beginning a career.

The occupations entered upon by individuals themselves are potent factors favorable to the recognition of talent and achievement. Woods² suggests that of two brothers, one engaging in farming or dairying while the other becomes a newspaper man, the chances of the farmer's appearing in *Who's Who* in comparison with those of the latter, would be as 1 to 5380. The banker has one chance in thirty-nine enjoyed by a writer. A physician is from a fourth to a fifth as likely to be "conspicuously successful" as a newspaper man. Even the lawyers and judges have but one chance in thirteen of getting into the Hall of Fame when pitted against the authors.

In considering the eighth environmental factor, the early

¹ Pigou, *Wealth and Welfare*, Chap. IV.

² Woods, E. B., "Heredity and Opportunity." *American Journal of Sociology*, Vol. XXVI, p. 161, September, 1920.

religious training, Clarke¹ reports that, for the period studied, the Congregational body stood far above its nearest competitor, the closely related Presbyterian Church. Of the 460 literati known to have had specific training in religion, 119 were born to members of this denomination. On the other hand the Roman Catholic, Methodist Episcopal, and Baptist had relatively few. But the matter of training in religion may have had little to do with producing literati during the period in question. Possibly other factors, such as the economic and educational factors, may serve to explain the differences discovered. It is well known that during the period 1771-1850, the Unitarians and Friends were, on the whole, in comfortable circumstances while the Roman Catholics were relatively poor. Another factor, such as freedom of thought, may have exercised its influence. One can simply conclude that religious training has played some part in the production of eminence.

As to the remaining environmental factor, the rank in order of birth among the children of the same family, Willis² submits results which suggest that: (1) first-born children are on the average slightly lower in intellectual ability than second born; (2) the extent of the difference is so small as to indicate that the part played by primogeniture is real but relatively small; and (3) the higher incidence of mental deficiency among first-born children may be due in part to the fact that they are the first-born children in families in which the rest of the children are properly classified only as "borderline" or "backward" cases.

Redfield³ suggests that children born to parents later in life have greater possibilities of becoming eminent. He insists that as a parent grows older his mental power is increased because of mental work performed. "I have been able to find but one man of considerable eminence who was born less than 58 years

¹ Clarke, *American Men of Letters*.

² Willis, C. B., "Effect of Primogeniture on Intellectual Capacity." *Journal of Abnormal Psychology*, Vol. XVIII, pp. 375-377, January, March, 1924.

³ Redfield, *Dynamic Evolution*, pp. 158; 159-166.

after his paternal grandfather, and that one person is Jonathan Edwards. In this case we find old parentage on both sides of the house immediately back of the grandparents." Terman¹ found that the average age of the father at the birth of a gifted child was 33.63 years, and of the mother 29.01 years.

Terman, on the other hand, finds no important selective factor which would give an abnormally large number of children whose parents were especially old or especially young at the birth of their gifted offspring. Cattell found the average age of fathers of 865 leading American men of science to be 35 years and that of the mothers 29 years and 8 months at the birth of their sons. The corresponding average ages of parents of 100 English men of science as found by Galton was 36 and 30 years respectively.

Terman found that the average ages of his 583 fathers of gifted children was 4.62 years in excess of the average ages of the mothers at the time of the birth of gifted children; also that longevity of the grandfathers of the gifted subjects was 2.35 years or more in excess of expectation.

Clarke² remarks that first born and last born frequently enjoy greater educational opportunity. First born often succeed in getting a start before the expense of caring for a large family becomes so great. The last born of a poor family may be favored by assistance from older brothers and sisters.

Ellwood³ reminds us that it is the stimulation of the social environment which develops talents and geniuses. The fruitful ideas of genius may be quite as much due to the social environment as to individual mental superiority. The person of intellectual ability first produces new ideas and standards. Some of them, but not all, are copied imitatively by the mass of society. His ideas, to be accepted, must be found adapted to the needs of the time. Inventions valued at a particular age

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. V.

² *Op. cit.*, p. 84.

³ Ellwood, *Psychology of Human Society*, p. 335.

will be only those for which the age is ready. In some cases social achievement is not fully realized until after the death of the individual.

Our vital concern is not with those whose gifts have been recognized, but with those who are great regardless of the world's recognition of them, and with those who may become eminent under proper guidance.

Cattell has shown that Massachusetts in proportion to population produces 84 times as many men of science as Mississippi. That scientific ability is 84 times as prevalent in the germ plasm of Massachusetts as in that of Mississippi is unreasonable. Educational opportunity has certainly helped in determining eminence.

Many of the men prominent in history owed their greatest opportunities to mere chance. Newton had the opportunity to enter Cambridge through a chance visit of an uncle. Binet was confronted with a problem of selecting children of the lowest levels of ability, thus making it necessary for him to devise a test for this purpose. If Trudeau had not been a victim of tuberculosis he would doubtless never have made his contribution to the world.

Certainly children of superior ability are not always recognized in school. The defective is nearly always found through his inability and maladjustment. The gifted child is likely to pass unnoticed because of his adaptability to school environment.

Origin of Talented Children. As already stated, talented children have been born to parents of all ranks of society. A relatively small number have seemingly been given special abilities by chance variation, but the dependable origin is with superior families and superior relatives. Terman¹ found seventy-three families yielding two superior subjects each, and nine yielding three or more each. The number of families with two subjects is more than twelve hundred times the number

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. V.

that chance would provide. Two and three-tenths of the entire number which Terman found in California are known to be related.

Among fifty-eight eminent relatives, there were six signers of the Declaration of Independence, two presidents of the United States, two vice-presidents, four generals, six writers, two inventors, four statesmen, three artists, and two supreme court judges.

The correlation found between the child's superiority and the size of the family in a study of 92 completed families was $-.271 \pm .062$.¹

PROFILE OF SUPERIOR CHILDREN

Locating the Subjects. Some measure of general mental ability should be used for all children at least at the time of entrance into school or soon thereafter. At present we must rely chiefly upon the individual test for the kindergarten and first grade, since very few group tests have been developed which are even fairly reliable for general use in sectioning these grades. For lack of time the writer has used, with considerable success, a few oral questions which he asks each child. Among questions used are the following: (1) How old are you? (2) When is your birthday? (3) What day is this? (4) On what street do you live? and (5) What is the number of the house in which you live? The child who knows his age and his birthday on entering the first grade is normal or above. The subnormal child, even at the age of fourteen years, on being asked his age will often answer, "I don't know, my mamma knows."

During the first year in school a practical measure of normal intelligence and above is progress in learning to read. As pupils may be entering any grade by transfer during the school term, there being no adequate opportunity for using a standard measure at the time, the principal can use to good advantage the age-grade table:

¹Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. VI.

Age	Grade
6.5 — 7.0 years	Low 1
7.0 — 7.5 "	High 1
7.5 — 8.0 "	Low 2
8.0 — 8.5 "	High 2, etc.

Placement should be verified at the earliest opportunity by the use of a suitable group test or series of such tests, and a record of individual general ability to respond to school situations should be made.

To what extent can teachers select bright and dull pupils? The answer to this question depends upon the extent of special training for and experience in making such selections. Without much more specialized training than is usually possessed, a teacher can select subjectively from 20 to 40 per cent of the bright pupils and from 50 to 60 per cent of the dull pupils in her room.¹ It is far more difficult when pupils are young to select the bright than to select the dull, but it becomes less difficult as they grow older.

Age of Learning to Read. Reference has been made to learning to read as a means of locating the subjects. Terman² found that

- 2 per cent of children learn to read at 2 to 3 years of age.
- 12 per cent of children learn to read at 3 to 4 years of age.
- 14 per cent of children learn to read at 4 to 5 years of age.
- 35 per cent of children learn to read at 5 to 6 years of age.
- 35 per cent of children learn to read at 6 to 7 years of age.
- 2 per cent of children learn to read at 7 to 8 years of age.

The above figures refer of course to unselected children, but it is certain that the most talented pupils of all who enter a low

¹ Varner, G. F., "Can Teachers Select Bright and Dull Pupils?" *Journal of Educational Research*, Vol. VI, pp. 129-132, September, 1922.

² Terman, *Intelligence of School Children*, p. 178.

first grade are among those who learn to read before they are six years old.

Nearly half of the gifted children reported by Terman learned to read before entering school. At least 20 per cent learned to read before the age of five years; at least 6 per cent before four years; and at least 1.6 per cent before three years of age. Most of these learned to read with little or no formal instruction.¹

The writer is urging the earliest possible location of bright pupils. By the time children have reached the third or fourth grades it is entirely possible that certain habits have been formed which militate against securing as high scores in group tests as these children otherwise could obtain. Undoubtedly, children of superior mentality should not waste their time even in lower grades, while the teacher is struggling with duller minds. We should experiment with the plan to allow them to use their extra time in freer, happier, and more rewarding ways.²

Bright pupils differ to the extent of requiring radically different procedure in the educational process. The shifting of teachers from fast to slow groups or vice versa from term to term involves a tremendous social waste. Teachers cannot abruptly adjust themselves to such radically different teaching processes. Some traits of upper mentality groups follow:

1. They learn by association rather than rote.
2. Their natural linguistic interests and wide range of association and experience minimize vocabulary difficulties.
3. Instructional units can be longer and actual projects of considerable complexity can be undertaken.
4. With certain exceptions the gifted are more interested in school subjects that are abstract, and less interested in practical subjects. Their interests are much stronger in dramatics and literature and much weaker in handwriting, manual training, etc.

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. X.

² Holmes, H. W., "Intelligence Tests and Individual Progress in School Work." *Twenty-First Year Book, National Society for the Study of Education*, Pt. II, pp. 117-122. Bloomington, Illinois, Public School Publishing Co., 1922.

5. Motives are easily aroused for excellent work. When interested, they become skillful in physical activities, manual training; and in situations requiring motor control.

6. They have greater spontaneous interest in intellectual matters, and rate lower in mechanical ingenuity.

7. Their instincts and emotions are better controlled; they make use of deliberation and generally reflect intellectual judgment to a high degree.

8. Being so highly adaptable they need expert guidance and should be permitted to assume various duties and functions to the full extent of their powers.

9. Ordinary control problems do not arise, but the necessity for constructive discipline should not be underestimated. Gifted pupils are highly subject to appeal.

10. Gifted children have more enthusiasm than average children, and their interests appear no less wholesome.

11. One and three-fourths times as many gifted as control children have made collections and more than twice as many have collected material of a scientific nature.¹

12. Gifted children show measurably greater interest than the control children in activities requiring thinking and that are mildly social and quiet. They show slightly less interest in competitive games. Activity ratings were lower for girls than for boys and for the gifted than for the control groups.²

Sex Frequency of Eminence. The fact that among eminent people there have been more men than women offers no enlightenment on the subject. The difference found is due in part to differences in opportunity and education. Very few women born as late as 1850 enjoyed a college education in the United States. The proportion, however, graduating from secondary schools was becoming increasingly pronounced. Professor Clarke says, "in all probability the chief reason for the increase in the number of literary women was the improvement

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. XIV.

² *Ibid.*

in the social environment. This improvement had another aspect besides the disappearance of the ban of disapproval . . . It included also the decline of the idea that women should not receive higher education.”¹ Other vocations than literary pursuits available to women, or even certain fields of literary work, were not favorable to the recognition of eminence.

“The evidence seems to point to the conclusion that the question of mental precocity as related to sex must be answered in terms of specific functions or traits, rather than in terms of unanalyzed general tendencies.”² Mental differences between the sexes are very small as compared with the amount of variation found between members of the same sex. Educational procedure may safely ignore them. Sex differences in mental traits do exist, however, and in measurable degree; but the pattern or profile of abilities which tend to characterize either sex remains relatively constant from early childhood to maturity. Other conditions being the same, to say, then, that the frequency of genius for one sex is greater than for the other would be to name the function which by original nature or environment is more favorable to the sex named.

Health and Physical Traits. Terman points out significant traits of gifted families. Infant mortality is found to be about two-thirds of that expected in the case of boys, and only one-third of that expected in case of girls. This good showing might indicate better care, better heredity, or both.³

Chronic illnesses among parents of gifted children are probably fewer than would be found for adults of corresponding age in the general population.

Four-tenths per cent of the parents and three-tenths per cent of the grandparents were reported by physicians as having had

¹ Clarke, *American Men of Letters*, pp. 69-70.

² Goodenough, Florence L., “The Consistency of Sex Differences in Mental Traits at Various Ages.” *Psychology Review*, Vol. XXXIV, p. 459, November, 1927.

³ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, p. 119.

a record of insanity. Very few other cases of hereditary defect were reported.

Boys are superior to girls in all physical traits measured up to twelve years of age, except width of hips, length of leg, and weight. In these respects girls begin to show earlier superiority. Gifted California children as a group surpass the best standards for American born children in physical growth status for height and weight. A large proportion have broad shoulders and hips, strong muscles, and well-developed lungs.¹ These gifted children excelled those of a control group in Oak Park, Illinois, in four selected physical traits: (1) arm span; (2) width of shoulders; (3) width of hips; and (4) grip. As a whole they were physically superior to various groups used for comparison.

To understand more fully the comparative physical status of gifted children, some facts should be known regarding their infancy and early childhood. Terman² found that the mean birth weight was approximately three-fourths of a pound above the norm of accepted standards. Only 8.2 per cent of the gifted were bottle fed during the entire period. Forty-seven and one-half per cent were entirely breast fed, and about the same number were partly breast fed. This proportion of breast feeding was considerably higher than for the general population, and was appreciably higher for the cases above 160 I. Q.

Health during the first year was rated by the mothers as excellent or good for 74 per cent of the cases and very poor for only 3.3 per cent.

Age at beginning to walk averaged about one month less than for learning to talk, and 3½ months less than the mean ages of normal children. Dentition was perhaps slightly precocious.

Symptoms of general weakness were reported by the school nearly 30 per cent less frequently for the gifted than for the control group.

Marked or extreme mouth breathing was reported with only

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap.VII.

² *Ibid.* Chap VIII.

one-third the frequency for the gifted as for the control group.

Defective hearing according to school reports was $2\frac{1}{2}$ times as frequent among the control group as among the gifted.

Sex characteristics and functions develop earlier among the gifted children of both sexes. Abnormalities of genitals were rare.

At all ages these children are taller, heavier, better nourished, and physically stronger than unselected children. They are freer from organic diseases and have a clearer disease history. Nervousness, stuttering, chorea, and other neurotic symptoms occur with no more than normal frequency. They sleep 30 to 60 minutes longer each day.

The all-round superior pupil is not likely to be overworked in school, although school processes and methods may be tedious to him. There is definite correlation between physique and intelligence. The highest correlation found between traits is shown between strength of grip and intelligence rating.

Hygiene of the Superior.¹ The mental hygiene of the superior child is emphasized, not merely by such as are frequently handicapped by unfortunate inhibitions developed in pre-school life, but by the records of great men and their methods of work and mental regimen or lack of it. Think of Darwin, Milton, Byron, Huxley, Spencer, Wagner, and their suffering and waste of energy from indigestion, eyestrain, worry, and mental conflicts. Attention has been placed on those on the lower level of health and efficiency, the ailing, the neurotic, and the defective. Equal attention should have been given to the superior, who in spite of hardships and physical defects are able to do important work.

Hygiene of the superior has not been adequately studied. The gifted should be trained to obedience in some things but should be left largely to develop naturally in earlier years. Varied opportunity for spontaneous activity is a rich natural environment with varied stimuli. Let them do tasks adapted

¹ Burnham, *The Normal Mind*, p. 265.

to their ability and be protected from unfortunate inhibitions. Avoid the development of a sense of inferiority or an overdevelopment of individualism.

Educational Progress. Terman has determined that gifted children enter the first grade in school at $6\frac{1}{4}$ years of age. The low first grade is skipped by 21 per cent of the children, and the entire first grade by 10 per cent. Their average progress quotient is about 114, thus showing a 14 per cent acceleration. In mental age they are 48 per cent above normal. Comparing the 48 per cent superiority and the 14 per cent acceleration we find that they are 34 per cent underpromoted. This is one-third of their chronological age. "The typical gifted child has already mastered subject matter 35 per cent beyond the moron for his age," but he is actually accelerated but 14 per cent of his age. The typical gifted child is accordingly being retarded 21 per cent of his age below the level to which he has already mastered the work. On the other hand the moron is usually accelerated beyond his ability to do good work by virtue of his size and age, and time served.

The gifted child is not markedly one-sided in his mental development. He does the highest quality of work where success depends on the higher mental processes. In all-round information the eight-year-old gifted child is equal to the average twelve-year-old.

At a given age there is practically no correlation between educational accomplishment and the number of terms the gifted child has attended school. The causes for school success and failure are not thus revealed. The discrepancy in the first grade between the mean chronological and mental ages is 2.8 years. By the time the fifth grade is reached this discrepancy has increased to nearly 5 years. Even by the usual standards 85 per cent of the gifted are accelerated, and not one is retarded.¹

Roughly 70 per cent of the parents reported that the home

¹Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. X.

allowed the child to progress at his own pace in school, 20 per cent encouraged rapid progress, and 10 per cent actually discouraged rapid progress.

Fundamental differences in educational progress are based upon differences in peripheral organs, chiefly the sense organs, upon reaction time, neuromuscular coördination, and certain other factors such as the characteristics of the central nervous system. Even if we had a perfect measure of ability to progress in education it would not correlate with achievement. There are at least three factors which determine one's progress. They are *ability, application, and previous experience*. The relative influence of each of these varies with circumstances. Ability probably contributes no more than one-half to final achievement. "Genius achieves nothing without work," and "work achieves little without ability."¹

It is often claimed that superior children have no difficulty in taking care of themselves, and that they will survive well in school without much attention. This notion is not only traditional but very erroneous. Even if they could take care of themselves it does not follow that this lack of care would be wise, or that there is not serious need for suitable training. Superior ability may develop into almost any eccentricity, and needs watchful care even more than does the average or sub-normal. The child of superior ability must be given his full chance to grow, to work, and to have healthy offspring. In all probability superior children are as numerous as defectives, even though their frequency may not follow the curve of normal distribution. But they have not been given the attention bestowed upon the inferior children, nor given any special opportunity.²

Social Development. Gifted boys do not tend to be more effeminate in play interests than unselected boys. Their intellectual interests are not developed at the expense of social

¹ Pyle, W. H., "The Relation of Ability to Achievement." *School and Society*, Vol. XX, p. 408, September 26, 1925.

² King, *Education for Social Efficiency*, p. 298 f.

and activity tendencies. Beliefs to the contrary are not well-founded. There are gifted children who are eccentric, socially defective, and unpopular, but the proportion with these traits is apparently less than among children in general.

Gifted children more often prefer playmates older than themselves, and show less sex preference in selecting playmates. The girl shows less than the boy. Many gifted children have imaginary playmates and enter into imaginary activities. Data are not available along this line for average children.¹

Literary Tendencies. Gifted children read many more books than average children. They read over a wider range, and select books of science, history, biography, travel, folk tales, informational fiction, poetry, and drama. They are less interested in emotional fiction. Terman found the gifted child of seven years to read more than any control group age up to fifteen. The average gifted child of eight to nine years reads three times that of the average control group child of the same age. Among the control group who had reached the age of eight years, thirteen per cent read no books at all during a two-months' period. None of the gifted had so poor a record.

Intellectual Traits. There is considerable increase in intellectual interest with age, only slight increase in social interests, and no increase with activity interests. Boys surpass girls at most ages in activity interests, and girls surpass boys in social interests. About 90 per cent of the gifted children equal or exceed the average for unselected children in intellectual interests. The superiority of the gifted over the unselected in social interests is very marked. About 84 per cent of the gifted equal or exceed the mean of the unselected in social interests.

The greater intellectual interest probably is the cause for greater achievement, especially in arithmetical reasoning. Social interest and activity interest have of themselves practically no effect upon academic achievement.

Terman, Raubenheimer, and Goodenough found the gifted

¹ Cf. Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. XIV.

child significantly superior for both sexes at all ages. Eighty-five per cent of the gifted equal or exceed the mean of the control group. The gifted child of nine years has reached a character development level corresponding roughly to that of the unselected fourteen-year-old. The gifted girl makes a better score than the gifted boy. Sex differences seem much less significant among average children.¹

When gifted children are compared with unselected groups of normal children no significant one-sidedness in their mental development is discoverable. As far as unevenness may exist, it is on a much higher level. There are few cases of extreme unevenness among various quotients of a given child, but degrees of specialization large enough to be of possible significance are fairly numerous.

Information quotients of superior children correspond rather closely with their intelligence quotients. With the Terman group having I. Q.'s of 135, no child earned an information quotient as low as 110. Superiority of the gifted is greatest in general information, language usage and reading, and least in history and civics. Gifted boys excel gifted girls in general information, arithmetic, and spelling. Gifted girls of ten years and older are slightly superior in language usage.²

The average gifted child does about two hours of home work per week on assigned lessons. More than half of them have private lessons in special subjects, such as music, drawing, painting, dancing, and education in religion, and devote an average of six and one-half hours a week to them.

Parents of the Terman group reported superior ability in arithmetic in cases of almost half the group. Musical ability first appeared at an average age of five years, and other special abilities at an average age of six years. Indications of superior intelligence most often noted were: (1) quick understanding; (2) insatiable curiosity; (3) extensive information; (4) early

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. I, Chap. XIV.

² *Ibid.*, Chap. XI.

speech; and (5) unusual vocabulary. There seems no foundation for the belief that superior intellectual attainments are to any large degree the result of artificial stimulation or forced culture.¹

The proportion of pupils who would make good use of education beyond the eighth grade has been variously estimated at 12.5 per cent. Probably not to exceed one-fourth of these have all-round excellence which would distinguish them as superior anywhere. Irregular possibilities of high development in one or two directions may occur among those far below the general average. Musical and arithmetical prodigies may belong to the same type as the idiot *savant* in institutions. Some boys can tell the exact day of the week of any date for centuries back. This same abnormal development is found in otherwise quite normal persons. The following quotation describes certain abnormalities in a boy whose future was apparently not remarkable.

"When almost 6 years of age, Ben was walking with his father before breakfast, he said, 'Papa, at what time was I born?' He was told 4 A.M., and then he asked 'what o'clock is it now?' He was told 7:50 A.M. After walking about a hundred yards he turned to his father and stated the number of seconds he had lived. The father noted the figures and reckoned them out at home, and told Ben that he was 172,800 seconds wrong, to which he got the reply, 'Oh! Papa, you have forgotten the two leap years,' which was the case, although the extra day for leap year is not usually known to children of six."²

There are many infant prodigies of whom one hears no more. Kerr quotes the case of a boy, James Hinton,³ whose memory was marvelous. On being assigned six pages of history, Hinton read it once and repeated it verbatim. But one day rushing hurriedly from cricket to his lessons, there was a sudden lapse

¹ *Ibid.*, Vol. I, Chap. X.

² Quoted in *The Fundamentals of School Health*, by James Kerr, Chap. XIX.

³ *Ibid.*, p. 374.

of his exceptional power, "a sense of goneness," and it never returned to him.

Individual cases of precocity in some particular are not illustrations of genius. They may amass stores of learning through memory, but few have done much with it. They do not have the capacity to use what they have learned. The majority of extremely precocious children sink back to average with adolescence. Sakaki notes that in Japan they are often early suicides.

Real genius is also often precocious but on a less specific and specialized basis. Sir Thomas Young (1774-1829), the physician at St. George's Hospital, who established the interpretation of the hieroglyphics, discovered the accommodation of the eye, and propounded the undulatory theory of light, could read at two years, and by four had read the Bible through twice.

Karl Pearson¹ quotes two letters written by Francis Galton when but a child. The day before his fifth birthday, Francis Galton wrote the following letter to his sister:

MY DEAR ADELE:

I am 4 years old and I can read any English book. I can say all the Latin Substantives and Adjectives and active verbs besides 52 lines of Latin Poetry. I can cast up any sum in addition and can multiply by 2, 3, 4, 5, 6, 7, 8, (9) 10, (11). I can also say the pence table. I read French a little and I know the clock.

Five years later, December 30, 1832, he wrote this letter to his father:

MY DEAREST PAPA:

It is now my pleasure to disclose the most ardent wishes of my heart, which are to extract out of my boundless wealth in compound, money sufficient to make this addition to my unequalled library:

¹ Pearson, *Life, Letters, and Labors of Galton*. Vol. I, p. 66.

The Hebrew Commonwealth by John.....	9
A Pastor's Advice.....	2
Horne's Commentaries on the Psalms	4
Paley's Evidence on Christianity.....	2
Jones' Biblical Cyclopedia	10

 27

Character Traits. The typical gifted child ranks high in honesty and most traits likely to prevent delinquency and incorrigibility. There is little temptation to cheat, and he is more conscientious, less boastful, and less absorbed in questionable interests. The ratings of teachers and parents correspond highly with tests of these and other moral traits in arriving at these conclusions. In moral as in other traits the gifted are superior to the unselected.¹

High scores on all traits containing the *persistence* of the *motive factor*, and the *intellectual factor*, indicate that young geniuses possess these traits to an unusual degree. "We may conclude that the following trait elements appearing in childhood and in youth are diagnostic of future achievement: an unusual degree of *persistence* — *tendency not to be changeable*, *tenacity of purpose*, and *perseverance in the face of obstacles*, combined with *intellectual energy* — *mental work bestowed on special interests*, *profoundness of comprehension*, and *originality of ideas*, and the vigorous *ambition* expressed by the possession of the highest degree of *desire to excel*."²

The following three conclusions seem most adequate as a brief summary of character traits.

1. "Youths who achieve eminence have in general (a) a heredity above the average and (b) superior advantages in early environment.

¹ Terman, L. M., *School and Society*, Vol. XIX, pp. 359-364, March 29, 1924.

² Terman et al., *Genetic Studies of Genius*, Vol. II, Chap. XII, p. 180.

2. "Youths who achieve eminence are distinguished in childhood by behavior which indicates an unusually high I. Q.

3. "Youths who achieve eminence are characterized not only by high intellectual traits, but also by persistence of motive and effort, confidence in their abilities, and great strength or force of character."¹

Environmental Factors in Behavior. Dr. Cox has studied factors² of one hundred young men and women to determine the influences of various factors upon behavior. It appears that the reported influence of current events or movements and of travel is but slight. The reported influence of home, home training and discipline, breadth of home interests, community, and education is considerable; and the reported influence of reading, whether literary or scientific, approaches the highest possible score. The influence of each environmental factor is conditioned by the subject's degree of intelligence. The higher the intelligence the greater the influence of the factor and vice versa.

Heredity. Superiorities found can scarcely all be due to environmental influences. Superior individuals clearly have superior inheritances. Over fifty per cent spring from the top four or five per cent of the vocational hierarchy. Professional and semiprofessional classes account for more than eighty per cent. Unskilled labor furnishes but one or two per cent. Terman³ reports that one-fourth of the gifted children have at least one parent who is a college graduate. The average schooling of these parents is twelve years as compared with six years for the general population. Twenty-three per cent of the members of the Hall of Fame are known to have relatives among the Terman group of one thousand gifted children. The number of high officials, statesmen, generals, and writers is astonishing. "One boy of 180 I. Q. has 34 known relatives listed either in *Who's Who* or Appleton's *Cyclopaedia of American Biography*."

¹ Terman *et al.*, *Genetic Studies of Genius*, Vol. II, Chap. XII, p. 180.

² *Ibid.*, Vol. II, Chap. XI.

³ Terman, L. M., *School and Society*, Vol. XIX, pp. 359-364, March 29, 1924.

Earlier Studies of Eminence. Galton's *Hereditary Genius* was a study of adults "endowed with superior faculties." His eminent man was one who had achieved a position attained by only 250 in each million men; while his illustrious man was one in a million or even in many millions. Galton purposely studied only those who had ability and did achieve. All others were discarded.

Galton, Ellis,¹ and Cattell² selected their eminent people by a subjective measure. Cattell derived his list of 1000 eminent men in history by measuring the space allotted in biographical dictionaries. No name was selected not mentioned in two or more dictionaries. He concluded that some are born great, some achieve greatness, and some have greatness thrust upon them.

Ellis' *Study of British Genius* is based upon 1030 distinguished names appearing in the *Dictionary of National Biography*. His primary basis for selection was similar to that of Cattell's—the amount of space allotted in biographical dictionaries, but he excluded royalty and members of royal families.

All the investigators either state or admit that the eminent man may be great in the estimation of his contemporaries, of posterity, or both without being essentially a great man. Such greatness is apparent but not real. It is not due to genius nor associated with high talents or general native ability in the accepted sense. Yet because of our imperfect measures these men remain on our lists.

All obtainable indications favor the view that great eminence is coincident with great genius. We may, from a study of native endowment evidenced in youth, derive some knowledge that will contribute to a clearer understanding of genius in the making.

¹ Ellis, *A Study of British Genius*.

² Cattell, J. McKeen, "A Statistical Study of Eminent Men." *Popular Science Monthly*, pp. 359-377, February, 1903.

The problem of early mental development of great men cannot be approached directly because of the absence of an objective criterion of greatness. It is approached indirectly through a study of men whose greatness has been recognized.

Subjects for the study of eminent men who are also great should fulfill three essential requirements: (1) unquestionable eminence; (2) eminence resulting in unusual achievement; and (3) adequate available records.

Great eminence subjectively is determined: (1) by the century to which an individual belongs; (2) his nationality; (3) his profession, interest, or field of eminence; (4) length of life; and (5) heredity or family standing. Certain factors seem to have increased from one century to another the proportional number of eminent individuals other than royalty and aristocracy. The relative number of eminent men from a particular nation is largely a problem of opportunity (environment). Opportunities for eminence offered by the various professions have already been mentioned. It is evident that many eminent men are lost to society by death before achieving eminence. Of 400 of the world's greatest people, 25 per cent achieved greatness at ages 60 to 70 years; 35 per cent at ages 70 to 80 years; and 25 per cent at ages 80 to 90 years. Other factors being constant, the man who lives longest has the greatest opportunity to become eminent.

Questions and Problems

1. What is meant by atypical students?
2. What is an opportunity room? an ungraded room? What students should be placed in the opportunity or ungraded rooms?
3. What are the causes for poor reading? poor spelling?
4. How should a teacher proceed in making an analysis of the disabilities of her pupils in reading?
5. Suggest remedial measures for reading and spelling disabilities.
6. What are some correctives for slow writing?
7. What motivating devices are helpful in overcoming difficulties in writing, spelling, and reading?

8. What general types of errors are frequently made in the working of the fundamental operations in arithmetic? How should each be corrected?

9. Make a list of the special defects in mental processes.

10. What sensory defects may be a factor in the inability to do good school work?

11. To what extent can specific devices be used to overcome defects and develop abilities?

12. Is right- and left-handedness inherited? Should a teacher insist that a left-handed child learn to write with the right hand? Why or why not?

13. What is the cause of stuttering and stammering? Can these defects in speech be overcome? If so, how?

14. Does special ability in music, art, and handwriting correlate with intelligence?

15. What tests have been devised to measure talent in music? Of what value are such tests?

16. Are procedures which are valuable in overcoming difficulties in arithmetic applicable to reading and spelling? Why or why not?

17. Is group or individual instruction to be recommended for children with special abilities and disabilities? Explain your answer.

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Lewis Madison Terman

CHAPTER VI

INDIVIDUAL DIFFERENCES

INDIVIDUAL differences among people are commonly recognized; and that pupils are different is unquestioned. Whatever feature of intellect, character, or skill is examined, frequent illustrations of variability among individuals are noted. The significance of these differences in each trait studied for educational theory and practice is obvious.

Whatever may be thought and done about education is highly conditioned by knowledge about such matters as inborn traits, heredity, sex differences, specializations of mental abilities, relation of abilities to physical endowments, variability in mental and physical development, and the importance of environmental influences. The traditional American public school entirely ignores any thought of these matters. Pupils were often grouped alphabetically as if they were equal in respect to any and every trait. All were required to pursue the same course of study and assignments were uniform regardless of needs, training, or aptitude. In many respects our schools are still following these practices. It is well known that children just entering school differ widely in their ability to do first-grade work. Their ages range from five to seven or eight somewhat according to the minimum age for entrance and the state compulsory attendance law. Even if these children had equal ability, they would make very different records in the first grade owing to differences in development and previous training.

Exact knowledge of the nature and amount of differences in intellect, character, and behavior is essential in educational

theory and practice for two reasons. First, we need to know what human beings are, before attempting intelligently to improve them. This need includes knowledge of individual divergencies from the type as a whole as well as knowledge of human beings in general, or as Thorndike says: "Education needs knowledge of men as well as of man."¹ Second, it is necessary to know the causes of differences, the causes of variability in such traits as badness, wisdom, foolishness, skill, efficiency, alertness, and sensitivity.

Adequate training of teachers both in schools and in service to recognize and detect actual differences among pupils is extremely necessary. Teachers need to know:

1. How to detect differences in traits.
2. What variations are sufficiently important to make differences in school procedure necessary.
3. What causes the differences.
4. How differences change.
5. How to intensify differences.
6. The probable distribution of trait differences.
7. Special differences likely to exist in their fields of work.
8. Possible adjustments.
9. How these possible adjustments can be made.²

To detect differences teachers should carefully observe the behavior of pupils. With increased training they become skillful in recognizing certain behavior responses as indicative of differences. The teacher trained to recognize differences will not use such traditional terms as "lazy," "indifferent," "careless," "inability," "inattentive," and the like to account for failure to achieve, but will attempt to discover causes of such behavior traits. These causes may be revealed by studying individual records, referring pupils to the physician and nurse, by the use of various tests and measurements, by case investigation among pupils and parents well acquainted with the subjects, and by using data collected by the superintendent, princi-

¹ Thorndike, *Educational Psychology*, Vol. III, p. 143.

² Mead, *Learning and Teaching*, Chap. VII.

pal, special investigator, and survey experts. All of these resources should be utilized. Each source has its limitations but is helpful to bolster up more subjective evaluations which in themselves are very inadequate and unreliable. Records may be found incomplete, but even if kept with the greatest care, much important data can be gathered by the teacher which has been entirely overlooked by others. Even physicians often fail to note certain physical handicaps discoverable by a teacher. The physician has not been trained in the physical basis of education, nor is he primarily interested in that relationship.

Causes of individual differences may be grouped under various heads, the most important being:

1. Inheritance, from both remote and near ancestry.
2. Sex.
3. Maturity and previous training.
4. Environmental factors, including home life, community life and social background, school training, recreational experiences, church training and activities, and business activities.
5. Health, conditioned not alone by environmental factors, but also by individual health practices.

While it is of importance to note differences among human beings due to inheritance, sex, maturity, environment, and health, it is more essential to note what differences are beyond the control of ordinary educational endeavor and what differences are modifiable by education or may actually be due to training itself. It is the path of least resistance to say that a child is inferior because of his inheritance. This is a fortification too often used to hide behind in order to justify a teacher's failure to produce pupil adaptations which are naturally expected from the school. To say that inheritance is the cause of individual differences is equivalent to admitting that education can do little or nothing for the seemingly inferior child. To place emphasis upon environmental (training) possibilities is to magnify educational possibilities and produce a hopeful attitude. Likewise belief in the all-potent inheritance factor leads the teacher to conclude that the bright child will survive regard-

less of the kind and quality of training, and regardless of his environment and guidance. One emphasis relieves the teacher of responsibility, describes teaching as a means of getting a living, and side-steps responsibility; the other emphasis makes teaching a profession and magnifies it as a most important social service requiring extensive training and an understanding of the nature and needs both of the individual pupil and of society as a whole.

Individual Differences Examined. To clarify the extent of individual differences it will be helpful to show specifically how individuals respond to some particular educational situation. For this purpose we shall show in Table I the distribution of responses correct to the 120 test elements in the first half of the Gast Auditory Scale for Group Measurement of General Ability.¹ The table shows to some extent the distribution of eleven-year-olds although they are found in grades from low I to high VIII or perhaps higher. Naturally eleven-year-olds in the third grade make poorer responses than those in grade VIII.

Table II shows the distribution of responses correct to the same test elements for ages six to sixteen inclusive. It will be noted that some six-year-olds are able to make better scores than some sixteen-year-olds; and that for any given age there is a wide range of ability. For instance, one eight-year-old made 108 correct responses, while others of the same age made fewer than four correct responses to the same situations presented by the same examiner. This indicated variability does not convey the whole truth. There are eight-year-olds not examined by this test material who would score zero, and doubtless there are others who would score as high as the best sixteen-year-old, or would make 120 correct responses. The time element was the same for all ages and grades. In presenting this test material the time for each element is controlled and uniform for all.

¹ Skinner, Gast, and Skinner, *Readings in Educational Psychology*, Chap. V.

The reader must avoid the pitfall of assuming that an eight-year-old who makes 105 correct responses in the same time and under apparently the same conditions, has an ability seven

TABLE I
TABLE SHOWING DISTRIBUTION OF RESPONSES CORRECT
FOR 500 UNSELECTED ELEVEN-YEAR-OLDS
(FIRST HALF OF EXAMINATION ONLY)

RESPONSES CORRECT	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B
115-19								1				
110-14							2	0	5	2	2	
105- 9							3	4	7	2	1	
100- 4					1	2	7	5	7	6	1	
95- 9				1	1	4	4	9	7	4	1	
90- 4				1	3	3	6	5	4	3	1	
85- 9				1	3	6	6	4	4	2	0	
80- 4				2	4	8	7	5	1	1	2	
75- 9		1	1	3	8	13	8	6			0	
70- 4	1	1	1	5	8	10	7	1			0	
65- 9	1	1	1	4	8	8	7	1	1		2	
60- 4	1	2	3	6	7	15	6	1			1	
55- 9	1	2	2	9	4	6	7	1			2	
50- 4	1	2	3	9	6	9	3					
45- 9	1	2	6	10	4	4	3					
40- 4	2	2	4	6	5	2	2					
35- 9	2	4	6	6	2	5	2					
30- 4	2	4	2	7	1	3						
25- 9	2	1	2	3		1						
20- 4	1	1										
15-19	2											
10-14												
Total	17	23	31	73	65	99	80	43	36	20	13	500

times as great as the one who makes but 15 correct responses. Such a conclusion is not valid.¹ "All thought about individual differences must allow for the meaning of the scales and scores used."

The extent to which children are found unlike has been shown: (1) by statistical arrays of data on differences; and (2) by

¹ Thorndike, *Educational Psychology*, Vol. III, pp. 147-149.

graphic representations of these data which are usually shown by distribution curves and distribution surfaces. These data reveal: (1) that the range of differences within a non-selected

TABLE II
DISTRIBUTION OF SCORES BY AGES
(FIRST HALF OF EXAMINATION ONLY)

RESPONSES CORRECT	6	7	8	9	10	11	12	13	14	15	16
115-19						4	9	11	15	12	12
110-14					5	13	16	40	21	30	7
105- 9			1	2	11	21	37	63	43	25	4
100- 4				4	20	34	59	77	58	17	6
95- 9			2	9	22	36	47	53	44	16	4
90- 4				9	26	29	47	41	37	13	4
85- 9			2	15	34	41	36	45	42	11	
80- 4			4	16	25	45	40	33	15	6	
75- 9			6	28	44	58	36	29	16	7	4
70- 4		3	13	41	49	45	40	29	14	4	
65- 9		1	13	33	58	43	34	31	12	3	2
60- 4		1	21	54	61	51	36	18	11	3	3
55- 9		6	42	56	55	36	33	17	12	2	1
50- 4		4	34	70	41	51	20	18	4	2	1
45- 9	1	11	43	62	59	29	14	19	4		
40- 4	1	10	50	57	51	23	13	5	6	3	
35- 9	1	11	55	54	27	29	15	10	7	3	2
30- 4	1	13	44	62	39	18	8	7	3	3	
25- 9	1	20	38	38	29	18	8	5		1	
20- 4	2	29	44	44	21	5	3	2	1		
15-19	3	31	46	30	11	4	2	2			
10-14	3	35	29	32	11	3	5	1			
5- 9	5	28	25	25	4	6					
0- 4	9	12	10	7				1			
Total	27	215	522	748	703	642	558	557	365	161	50

group extends from near zero to genius when measuring a single trait; (2) that within a group selected with reference to a particular trait individual differences still appear; (3) as the number of individuals becomes greater, individual differences in the trait measured, when graphically represented, approaches the

normal curve of distribution; ¹ (4) that the differences in ability in each subject or phase of a subject taught in schools vary regardless of whether the group considered is of the same chronological age, the same grade or year, or for the school system as a whole; (5) that the abilities in a school grade may vary from the standard median or norm for that grade downward or upward to the standard median ability of one, two, or three years lower or higher. These conditions may be shown by the following graphic representation in which C is the median ability of the pupils of a given school year; B and B' representing medians for one year below and above the year considered; and A and A' medians for two years below and above the median for that year; and (6) that ability of pupils in upper grades,



SHOWING THE OVERLAPPING OF ABILITY IN CONSECUTIVE GRADE GROUPS

as indicated by standard test scores, to complete work at the rate of about two years in one is found to exist in about ten per cent of the cases. But in actual practice any effort to have them do so has doubtful value. To have them do the work of the grade twice as well or to do twice as much work during any one year is quite another matter.

What changes occur in differences is determined by the efficacy of factors which cause changes in differences. Whatever traits or abilities one possessed because of training are changeable by further training. Education may be conceived as adaptation to one's environment. So far as education, then, is possible, there is a change in individual differences both quantitatively and qualitatively. Thorndike says: "Equalizing practice seems to increase differences. The superior man seems to have got his present superiority by his own nature

¹ See figure on p. 122.

rather than by superior advantages of the past, since, during a period of equal advantages for all, he increases his lead."¹ Education or training does not reduce the inherent differences found among men.

Changes in differences occur probably because of superior learning capacity; and superior capacity makes possible a greater effect of the environment upon the individual. With lower levels of capacity the environment has a lessened effect. Changes in differences may occur also because of: (1) extreme differences in emotional responses; (2) sensory defects such as poor vision and defective hearing; or (3) physical inefficiency.

Organic Evolution and Individual Difference. Inborn traits are the result of organic change brought about by organic variation, heredity, and selection. They are mainly the result of biological forces. By this means the organism has distinct individual and racial traits both physical and mental. This organic change or evolution has provided original differences between individuals. No two individuals are born alike. Physically we note wide differences in height, weight, form, appearance, and expression. There are accordingly similar differences in mental traits. Some individuals are born with favorable endowments, others with unfavorable. Original strength or weakness, either physical or mental, while a matter of heredity, is likewise a matter of individual variation. It must follow, then, that there is no biological equality among individuals at birth.

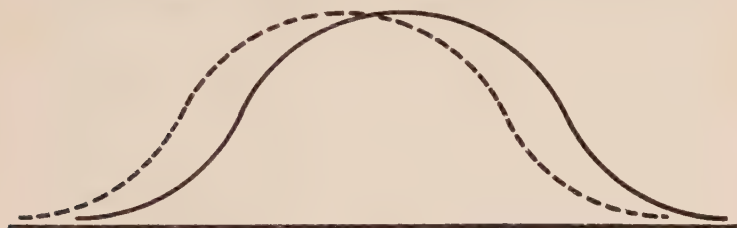
Individual Differences Due to Remote Ancestry or Race. Men like the American Indians spring from a common ancestry and so long as that ancestry remains common, unmixed with foreign ancestry, individuals may be expected mentally and physically to resemble each other and to differ from other races like Europeans, Asiatics, or Ethiopians. A distinct race consists of a group of men who have to a considerable extent in common the same remote ancestry. Thus it may be stated

¹ Thorndike, *Educational Psychology*, Vol. III, p. 305.

that by original nature they possess certain racial and mental tendencies.

While differences between races are known to exist, the question arises as to the significance of difference so far as education is concerned. "The most noticeable fact about the races of men seems to be their great mental variety."¹ Even in this respect the large differences, when carefully measured, seem to shrink to five or ten per cent. No two races have been thus compared which do not overlap mentally in whatever trait is measured.

The essential in education is adaptation to environment.



SHOWING CURVES OF DISTRIBUTION FOR TWO RACES
MEASURED IN THE SAME TRAIT

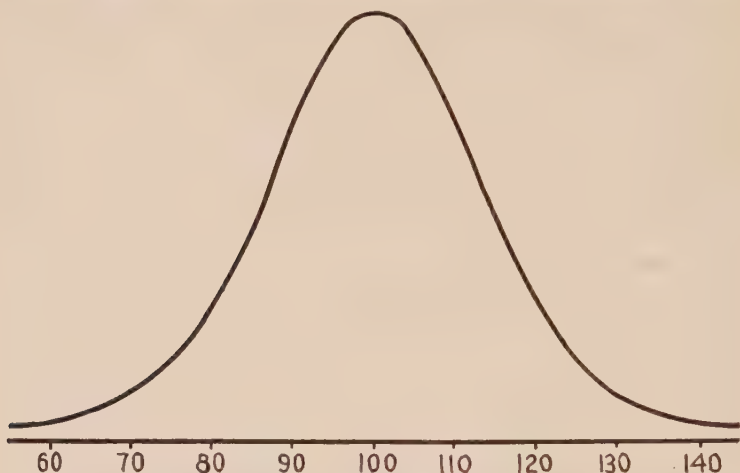
The fact that, with a given mental measure, one race seems superior in certain traits measured does not prove either superiority or inferiority. The test may be more favorable to one than the other. A Bushman may be able to count to the extent of his environmental needs, and even if a given race possesses training in higher mathematics, this fact does not prove superiority. Children of foreign parentage, speaking a foreign language at home, usually score low in a mental test involving English. We are inclined to say that such a child is not measured at all by the test rather than to conclude inferiority.

But on their own intellectual ground there are mental differences between the races. Children in Jewish schools in Cleveland are distinctly ahead of the average Cleveland pupils.² In

¹ *Ibid.*, p. 220.

² Edman, *Human Traits*, pp. 187-188.

spite of the fact that they may be surrounded by poor economic conditions and that they often use a foreign tongue, these children seem to overcome their handicaps better than any other race under similar conditions. Poles and Italians often make slow progress during the first year, follow the average more closely during the next four, then drop below the average. Both



A NORMAL CURVE OF DISTRIBUTION SHOWING VARIABILITY
WITHIN A RACE

are seriously handicapped by environmental and language factors. In his well known chapter on "The Comparative Worth of Different Races," Francis Galton declares that the negro race is inferior to Europeans by about one-eighth of the difference between such extremes as Aristotle and the lowest idiot. Even though such a difference exists, such a conclusion involves a tremendous overlapping and a wide variability within the race, as shown in the figure above. But in Galton's time there were no mental measures of the objective sort.

It must be kept in mind that whatever mental ability a race actually shows is due to the possibilities and conditions under which it operates. A race may eliminate certain conditions or

have them imposed or removed by other races through association and communication.

Until more accurate measures are devised, we are tending to conclude that mental differences between races are less significant than they have been estimated; that race origin is not as potent as origin within the race. Thorndike says: "Calling the difference between the original capacity of the lowest congenital idiot and that of the average modern European 100, I should expect the average deviation of one pure race¹ from another in original capacity to be below 10 and above 1, and the difference between the central tendencies of the most and the least gifted races to be below 50 and above 10."²

Bagley found that Army Alpha Intelligence Test scores of soldiers from the different states were closely correlated with the standing of these states educationally as measured by the Ayres Index. This correlation was found to be .72 which is relatively high. Thorndike and others have shown that twins correlate .80 and that brothers who are not twins have a correlation of .52. It is obvious that the colored soldiers, coming from the poorest schools in the states having the poorest school systems, could not be expected to make high scores on Army Alpha. Racial differences in intelligence patterns probably exist in small amount, but such differences in native capacity have not been proved scientifically by the Army Tests.

Wallis³ shows that it is very difficult to interpret measurements of primitive peoples in simple and complex mental traits owing to their previous experience, habits, and attitudes toward the examination. We have, he claims, no reason to believe that one race differs fundamentally from another in innate mental equipment, since the contribution of culture is so enormous.

¹ A pure race has been arbitrarily defined as one whose ancestry has less than one per cent of community with that of any other race for at least twenty generations back.

² Thorndike, *Educational Psychology*, Vol. III, p. 224.

³ Wallis, W. L., "Race and Culture." *Scientific Monthly*, Vol. XXIII, pp. 313-321, 1926.

Studies made of different groups within the white race show that the apparent superiority of certain groups tends to disappear after the second or third generation in America. This again goes to show that the racial groups which were assumed to be superior because the children made better school records or inferior owing to poor marks, were neither superior nor inferior insofar as their native ability is concerned. The social inheritance is simply reflected in the results. Consequently, probably most observed differences in psychological traits are the result of different educational and social forces at work. The best traits in all races are to be encouraged and developed.

Individual Differences Due to Immediate Ancestry or Family. There may be less agreement about the amount of ancestral influence than about that of remote ancestry. The problem naturally has two aspects: (1) the variability of individuals of the same sex and like ancestry; and (2) how much of this resemblance is due to training.

There is no reason to believe that sons of the same parents will have the same original nature. In fact they do not, except by chance. One son's success in school achievement is not a reliable indication of what the next son will achieve under the same conditions. Even twins, who in some cases have identical antenatal influences and training, may vary widely in both physical and mental traits. Ancestry or biological tradition like social traditions tends to limit variability and to determine the point about which variability is possible.

In almost any fairly large school will be found some children who will learn fewer things than some lower animals, and some may learn many more things than any of their parents. Or, the children of parents who are three inches above the average population in stature, "will not vary about the general average, but about a point two inches above it; and will differ one from another only about ten-seventeenths as much as one adult of the general population differs from another."¹ Immediate an-

¹ Thorndike, *Educational Psychology*, Vol. III, p. 227.

cestry, then, causes children to deviate from the general average toward the trait possessed by their parents; and causes them to be less variable in that trait than unrelated individuals.

Children do not originate from the minds and bodies of their parents, but from the germs of those parents. These germs are variable because no parent is of pure strain. Among immediate ancestors one may find a six-foot-six man and a five-foot-three man. Both might include some six-foot-six germs and some five-foot-three germs, and so on. Each parent gives to the future, not himself, but a group of germs differing among themselves. They are essentially bearers of inheritance.¹ Short parents may have tall sons, and gifted parents may have stupid sons. Such variations are by no means rare. Our problem, however, is to determine the amount of resemblance, not its frequency.

The argument is often presented that resemblance is due to similarity of training. But parents have never been able, by environmental influences, to determine the color of their children's eyes or hair. Parental resemblance must be due to resemblance in ancestry.

There is no reason to suppose that mental traits are any less influenced by ancestry than are the tissues which cause height, body build, quality of voice, or the deposits of pigment that cause eye color. The fact that physical traits are influenced by ancestry has been proved. On the other hand, all mental traits have their physical basis, and are due to physical causes. Individuals with unfavorable behavior respond similarly, although teachers and conditions change. Bad spellers likewise remain bad spellers. Mental traits of children are often paralleled by similar mental traits in parents, differing only in degree.

While it has been shown that differences in mental traits are very largely due to differences in ancestry rather than training,

¹ Most authorities would omit the word "essentially." It may be that to some slight degree germs are conditioned by training. They are certainly affected by the health of the parent.

it does not follow that better methods of training will not improve achievement at least fifty per cent, or that absence of training in arithmetic or spelling would not reduce achievement in those subjects to zero.

Individual Differences Due to Sex. What has already been stated regarding the variability within a race as compared to differences between races may be recalled with greater emphasis in relation to sex differences. Thorndike says: "The individual differences within one sex so enormously outweigh the differences between the sexes in these intellectual and semi-intellectual traits that for practical purposes sex difference may be disregarded."¹ Measurements lead us to conclude that equality in achievement is due to equality of natural gifts.

Whatever mental differences do exist because of sex are probably caused by differences between interests of the sexes. Many of these differences may be accounted for up to the present time by differences in training. We have been reminded that very marked intellectual weakness is commoner among men than women; that twice as many men are found in asylums for idiots and imbeciles. The fact stated does not prove the point in question. It has long been known that girls survive in society to a far greater extent than boys. This may be due to the attitude that males are more worthless when not at least self-supporting; while females can be given simpler forms of employment.

The most striking difference in instinctive equipment consists in the strength of the fighting instinct in the male and the motherly instinct in the female. Even this difference may be explained by differences in training. It is well known that pre-school boys often equal girls in their interest in dolls. They are told that they are boys and are trained as boys. On the other hand girls are trained more or less traditionally because they are girls. We have yet to be provided with conclusive evidence that there is much difference in mental ability due to sex.

Individual Differences Due to Maturity. Unquestion-

¹ Thorndike, *Educational Psychology*, Vol. III, p. 184.

ably as one becomes more mature, certain mental traits or inner mental growth cause him to differ gradually from his former self. The child differs from the adult in every fiber, every blood corpuscle, every bone cell, and in the relative proportions of all his parts. "His resistance to disease, his power of recuperation, his food and sleep requirements are all unlike those of the adult. He is differently affected by every element of environment and regime."¹ It should not be inferred, however, that childhood is characterized by its plasticity. The so-called plasticity of youth as differing from that of maturity is probably nothing but a myth. There is no available evidence to the effect that a mature individual is unable to learn as efficiently as he did during childhood or youth. If one has built up proper habits there is reason to believe that with maturity he is more able to learn than at any other period prior to the onset of senility, other conditions being equal. An individual's mental maturity cannot be inferred from his chronological age.

A scientific determination of differences in mental traits with age can be established only by repeating measurements upon the same individuals. Each individual change must be preserved, and an account taken of the training which each individual has undergone. Even without having completed this process it is clear that increases in ability due to a unit of progress toward maturity are not alike for all. Nor is it true that maturity is the main factor in differences found among children. We have already noted that some eight-year-olds can do as well in a given mental function as some sixteen-year-olds, and this is not an extravagant statement.

Among children entering a low first grade, it is reasonable to expect that because of greater maturity some will do better work in school than others. Under the same tendency older children will always do better work provided they have equivalent native capacities for learning and adaptation.

It is agreed that maturity does have a direct influence on

¹ Terman, *The Hygiene of the School Child*, pp. 47-48.

mental traits; but no precise measures are available because of our inability to isolate the maturity factor. Maturity is not as potent as either ancestry or environment. Thorndike says: "Even the topmost limit for the average effect of . . . maturity is surely less than one-sixth of the effect of the extreme differences in ancestry and training upon children of the same age."¹

Previous Training. Education has to reckon not only with differences due to race, near ancestry, sex, and maturity, but also with differences due to previous training. Each pupil of any particular age group, such as ten-year-olds, has been subjected to training differing more or less from that of any other. His social backgrounds and environmental influences may, on the one hand, be very different, and on the other, he may be through heredity more or less affected by those influences. Probably identical training for two or more individuals is not a reality.

Because of differences due to previous training, education should be more fully adjusted. This adaptation may involve method; kind, amount, and quality of work demanded; and the amount of necessary direction. The teacher should expect variety in human beings and should inventory their individual needs. Educational procedure on any other basis is not adequately rational.

Individual Differences Due to Environment. The term environment includes all agencies for intellectual, moral, and civic education. While precise quantitative evaluations may scarcely be available for many of these agencies as to their potentialities in causing individual differences, they should at least be studied. Environmental elements act differently upon different types of original nature and at different age levels. Often their action must be observed over long intervals of time.

The adaptation of an individual to his environment is not proportional to his opportunity. That is, it cannot be foretold from the degree of opportunity just how well adapted one may become. Thorndike says: "Being treated like slaves may not

¹ Thorndike, *Educational Psychology*, Vol. III, p. 280.

debase all and never debases all alike. The product of the environment is always a result of two variables, it and the man's nature."¹ To this axiom he adds two corollaries: (1) "That the environmental stimulus adequate to arouse a certain power or ideal or habit in one man may be hopelessly inadequate to do so in another." (2) "Each man in part selects his own environment." The traditional schoolroom had a random grade selection of pupils and set up the same stimulus for all. It is not strange that such procedure produces a high percentage of failure. Even when pupils are selected according to ability to do school work there is a wide range of difference, but this range is generally minimized. Each pupil responds according as the stimulus for the particular power, ideal, or habit is adequate; and fails to respond according as it is inadequate. Too long have we treated pupils as if they could all improve to a like degree from the educational stimulus presented even though they are of different ages, of different original natures, and of different social and empirical backgrounds.

What one can do and how difficult work he can do is largely a matter of his stimulation to action and his reward for action. It is certain that to whatever extent a well-organized and well-equipped school is not functioning in society, that hypo-function is largely due to the free and easy school-keeping characterized by lack of stimulation to action and inadequate reward and praise for right responses.

But educational psychology must not deal too narrowly with environmental influences as if they were essentially related to the school. The more primitive and fundamental of human traits, such as energy, capability, persistence, leadership, sympathy, and coöperation, are largely stimulated in all social situations. If one's original nature will not respond to his need for these traits and to the rewards constantly being offered for them, what accomplishments can be expected from the paltry schoolroom exercises? Secondly, the school should not waste time

¹ *Ibid.*, p. 284.

and energy undertaking what it cannot do. It cannot create intellect, but it can prevent a waste of it. It cannot cause the learning of all suggested subject matter to be useful to the child, nor equip all to be potential millionaires; but it can function in the development of proper attitudes, and habits of efficient associative living. A third fact too often ignored is that morality, right habits, attitudes, and desires are far more susceptible to environmental influence than intellect. The school should proceed rationally and place emphasis within the field of greatest need and more possible achievement. The development of powers and capacities is not highly affected by educational forces. That which can be done best is to equip with useful ideas and with habits and attitudes socially beneficial.

Relations Between Mental Traits. There are many notions about the relations between certain mental traits. First, by the supposed law of *compensation*, superior ability to get impressions through one sense is related to inferiority in getting impressions through other senses, or that superiority in one trait is paralleled by some other inferiority. Studies of Meumann, Thorndike, Cattell, and others, on the contrary, show that a person who is superior in one trait is more likely to be superior in another; that individuals who learn rapidly generally retain longer; and that one who works at high speed often works more accurately than does the slow worker.

Certain relationships seem to be antagonistic. General intellect seems antagonistic to sullenness, and intellectual efficiency to emotionality. But on the whole negative correlations between "adaptabilities" or desirable traits are rare.¹

Another prevailing notion is that the functions which we group under attentiveness, neatness, observation, industry, and the like are perfectly correlated; that high attentiveness to school work in English or history is closely related to attentiveness to social duties, business, and to other facts in individual experience. Such measurements as have been made reveal on

¹ Thorndike, E. L., *Educational Psychology*, Vol. III, p. 363.

the contrary a high degree of independence of mental functions. A good memory for figures does not mean the same for names. We no longer speak of memory, but of memories, and abilities. Good reasoning power is but a general name for a host of particular capacities and incapacities, the general average of which seems to be above that in other individuals.

The mind must be regarded as a multitude of functions and not as a functional unit. Many traits seem to be quite independent of each other. It is easier to show that mental traits are not related than to show just how they are related in certain ways. No special types of individuals are found in which certain traits are associated either positively or inversely. On the other hand the relation is seemingly positive between intelligence and many desirable social traits. A highly intelligent individual does make more right responses than one not so intelligent. In fact, intelligence has been defined as ability to make right responses.¹ A striking exception to this relationship has been cited in the existence of highly intelligent criminals.

When pupils are grouped according to relative intelligence objectively measured, there is a much higher degree of homogeneity with reference to their social traits. This may be accounted for by the fact that brighter children come from homes which provide more adequate care for physical welfare and more highly approved training — homes in which their superior native capacity is used to assimilate social and moral virtues from their environment. Under such conditions a high correlation of intelligence and character is to be expected. Under very different conditions a high correlation between low intelligence and undesirable character traits may likewise be expected.

Physical Causes of Individual Differences. In any selected group of children of the same ages such as nine-year-olds, may be noted decided physical differences. The group shows

¹ Right responses of course are those most nearly conforming to social ideals, attitudes, and standards.

much variation in height, from perhaps three to about four and one-half feet. They disclose equal variation in weight covering a range from about fifty-five pounds to one hundred thirty pounds. In this group there is great difference in agility of movement, in ability to lift weights, in physical endurance, and in variation of health. These differences may be classified as: (1) hereditary, and (2) environmental. Certain differences such as limitations in eye color, body build, and organic tendencies toward strength or weakness are hereditary and their modification is generally impossible. Other differences while limited by ancestry and race are modifiable by habits of living. Educational and professional men and women are clearly taller and heavier than the average. This superiority is largely due to proper and adequate food and home comforts during childhood and youth while the body is growing. Other physical differences are due almost entirely to environment.

Glands of internal secretion, including the thyroid, adrenal, pituitary, and sex, while dependent upon hereditary influences are known in certain cases to function differently in various environments. Individuals with rather extreme thyroid enlargement in the Great Lakes region, on moving to sections along the coast become entirely normal without any contributing factor being involved except change of residence. According to a resurvey¹ of endemic thyroid enlargement in Cincinnati, 22.5 per cent of the boys and 39.2 per cent of the girls have enlargements.

Children with deficient thyroids do not grow into normal adults. Their skin is dry and hairless; their sex glands do not develop normally; they have lowered temperature and metabolism, pulse slow and weak, and minds that are dull. Miraculous results have been produced by feeding thyroid extract. Enlargement of the thyroid is called goiter. But an over-

¹ Olesen, Robert, "A Resurvey of Endemic Thyroid Enlargement in Cincinnati." *Treasury Department Public Health Reports*, No. 3, pp. 113-121, January 20, 1928.

developed or hyper-functioning thyroid produces exophthalmic goiter or Graves' disease, characterized by increased metabolism and blood pressure. Thyroid hormone is called thyroxin and contains 65 per cent of iodine.

It is possible that no life exists without iodine. Normal human life is impossible without one one-hundredth of a grain of thyroxin a day. Three and one-half grains of thyroxin are all that stands between intelligence and imbecility, but there are of course many causes for subnormal mentality other than hypothyroidism. Remove a tadpole's thyroid and it never becomes a frog but remains a tadpole for life. Feed a tadpole thyroxin and it becomes a frog in two weeks instead of a year; but it remains only as large as a fly. Evidently thyroxin feeding hastens metamorphosis but retards growth.

No limit of function can be assigned to any one endocrine because each is part of an organic whole. Although much is known, the whole story is not known.

Closely associated with the thyroid are two other endocrines called parathyroids. They are about the size of peas and are paired, generally two on each side near the thyroids. Their function is not yet understood but their removal causes death generally in from twelve to forty-eight hours.

There is even more doubt regarding the thymus gland whether it is a gland, or what happens when it is removed. It is well developed in the fetus, better developed at the age of two, and largest at puberty. Then it begins to lose its character, this change being delayed by castration. It is assumed to hold in check the development of the sex glands until puberty. Dorsey reports a post mortem examination of 400 idiots, 75 per cent of whom showed no thymus.

The adrenals are named from their position just above the kidneys. Removal of one adrenal produces no known result, but the removal of both is fatal. The hormone adrenalin is a powerful drug, the meaning of the dilution of which is better understood in terms of street sprinklers, each containing 625

gallons capacity: "A procession of such sprinklers twenty miles long and 200 to the mile would hold just enough water to dilute one ounce of adrenalin down to one dose. Large doses are fatal." ¹

The pituitary gland near the center of the head is about as large as the tip of the little finger. This gland is essential to normal life although not a vital organ. It seems to be associated with the rate of growth and sexual development. Pituitary hormone is about 250 times stronger than that of adrenalin.

The pineal gland, about the size of a grain of wheat, lies at the base of the brain and above the pituitary. No pineal hormone has yet been discovered nor are we certain about its being a gland. It is inferred that its function is to promote early physical growth and retard sexual development.

The gonads or sex glands are not essential to life. They are necessary to individual life only for race perpetuation. Sex characters begin to assume definite form in both sexes at the dawn of puberty owing to by-products of the male and female gonads. They secrete a hormone which regulates the appearance and growth of secondary characters and causes sex behavior.

For ages it has been recognized that boys and girls deprived of their gonads before puberty develop characteristics of the opposite sex and throughout life retain an infantile type of body and corresponding elements of behavior. The removal of the ovary is the removal of the sex nature of the individual, but life is not shortened nor mental or physical efficiency impaired.

Evidence seems to indicate that gonadectomy of the two sexes leads to opposite changes in the adrenals. In males there is an increase of 15 per cent and in females a decrease of 20 per cent, resulting in an increase of resemblance between the sexes.

Handedness. For the purpose of studying the problem of handedness along somewhat new lines and to discover if possible new data relating to the problem, a list of thirty activities

¹ Dorsey, *Why We Behave Like Human Beings*, Chap. IV, p. 211.

has been used by the writer in case studies of 169 males and 164 females aged twelve years or older. Certain of the original list of activities have been discarded from this report because of being peculiar to one sex only, or not being common to all the cases studied. The original list was thus reduced to twenty-four different activities. In obtaining the responses, each individual was required to go through the motions of performing each particular act, and whenever possible actually to do the thing suggested. A record was made as to which hand or foot was used, without revealing to the subject whether he was using the right or the left.

The list of twenty-four activities is submitted by number.

ACTIVITIES EMPLOYED IN CASE STUDIES OF HANDEDNESS

1. Hand used in throwing a ball
2. Hand used in hammering
3. Hand used in spreading bread
4. Hand used in eating food with fork
5. Hand used in cutting meat
6. Hand used in cutting bread
7. Hand used in drinking from cup
8. Hand used in brushing teeth
9. Hand used in brushing hair
10. Hand used in brushing clothes
11. Hand first thrust into sleeve in putting on coat
12. Hand used in buttoning clothing
13. Hand used in writing
14. Hand used in receiving food at table
15. Hand used in passing food at table
16. Hand used in holding food eaten from hand
17. Hand used in eating with spoon
18. Stocking put on first
19. Shoe put on first
20. Hand nearest shovel when shoveling coal or snow
21. Hand nearest floor when sweeping with broom

22. Hand preferred in carrying packages
23. Hand usually used to turn knob of door
24. Foot used in kicking ball

Some observations are as follows:

1. There is a high degree of right-handedness with both sexes. This may be due to the nature of the activities themselves. A list could be made which would show the opposite tendency.

2. No individual was found to perform all the acts with one side of the body only. Every individual dominantly right-handed performed one or more of the acts with the left hand and vice versa.

3. One girl eats pie with a fork in the right hand but always eats soup and cereal with a spoon in the left hand.

4. Several individuals were found to perform as many acts with one hand as with the other. They seem neither dominantly right-handed nor left-handed.

5. One of the girls offered the information that she sews with the right hand, but uses shears with the left.

6. The dominantly right-handed are usually left-handed in acts 20 and 21 and vice versa.

7. Of thirty-three cases with speech defect included in the above data, none could be attributed to the change from one hand to the other in making a particular response, such as changing the hand in writing.

Traditional notions of handedness attribute the tendency to use a particular hand to heredity. One eleven-year-old boy¹ recently revealed his training. "I do everything left-handed. I was born that way." But even he unconsciously performs four of the activities listed with his right hand. It is scarcely conceivable that an individual inherits tendencies to use a particular hand or foot for tasks absolutely artificial. It seems more reasonable that he steps from an escalator with his right

¹ Not included in this study.

foot, holds a book with his left hand, adjusts a parking brake with his right, uses both feet in controlling an automobile, and both hands in playing a piano or operating a typewriter because of the great adaptive power of his response mechanism rather than that he inherits those tendencies.

Several questions of educational significance pertaining to handedness have been answered and educational policies determined without the use of scientific data. The study of these 333 cases leads the writer to conclude:

1. that the unguided individual begins to use that member for making a particular response which is most available for that purpose;

2. that the individual can naturally be guided to make a particular response with whatever member will render him more efficient individually and socially;

3. that the child can and should be encouraged to perform certain acts with one hand and certain ones with the other or with both according to his physical advantage and social environment; and

4. that people are right-handed or left-handed with reference to the particular response only.

Speech Defects. Some two or three per cent of our pupils fail to respond well in oral language because of lisping or stuttering. The more common and less serious defect is lisping which consists of omitting, transposing, or distorting sounds, as in pronouncing *s* as if it were *th*. If lisping continues beyond the age of six the teacher should guard against causing the child to shrink from speaking, but should show him privately how to correct his error. The child should receive as much special drill on sound production as he seems able to bear and should understand how to place his organs of speech so as to master the sound difficulty. Lisping is usually caused by wrong placement of these organs, such as wrong tongue placement when front teeth are missing. It is usually entirely overcome by the sixth grade in school.

Stuttering consists of spasmodic hesitations or repetitions, or even not to utter sounds at all. It is most common in childhood and frequently before the age of six. "It is three times as frequent among boys as among girls."¹ But this statement of fact seems to need further verification. Stuttering often dates from some disease or some mental shock. Scripture's explanation is that a brain connection is blocked by an emotional disturbance. If the individual speaks in a high voice, or sings, or speaks in a language other than his mother tongue, he is not likely to stutter at all. He is using a different set of bonds. La Rue states that in nine cases out of ten stuttering can be cured, and usually in a few months. The two great causes seem to be brain weakness and brain-blocking; the remedies suggested are bodily hygiene and mental treatment. Considerable success has been won in special health schools by removing all inhibitors, such as family comment, school ridicule, and self-consciousness, and by arousing self-confidence — "I *can* control my speech." A special teacher may be desirable but it is more necessary that such teacher work with regular teachers and train them. A special teacher can do very little without the coöperation of regular teachers.

Almost Every Child is Good for Something.² Leaving out of consideration idiots, and imbeciles, it should be emphasized that every child can be made a useful individual in many respects. With this ideal in mind the elementary teacher becomes most potent in helping each child toward general and special social usefulness. It is important that the teacher be conscious of the great variety of human capacities, and the opportunities for each to be of service. A child should never be disregarded because of his apparent abnormal tendencies. Too often teachers may be inclined to minimize possibilities of training in usefulness because of an assumption of bad heredity or family influences. It is the road of least resistance.

¹ La Rue, *The Child's Mind and the Common Branches*, pp. 252-255.

² Parker, *General Methods*, p. 309.

Curricular Adjustments.¹ Possible adjustments to improve instruction, made necessary by individual differences, are not always evident. The following adjustments are being used: (1) classification of learners into ability groups as nearly alike as possible. This plan must consider not only native ability, training, physical fitness, and the like, but it should consider social backgrounds, which are largely responsible for the ideals, attitudes, and much of the training of the individual. (2) The adoption of different objectives for pupils of varying degrees of abilities, capacities, habits, ideals, and attitudes. These objectives may be purely intellectual, aesthetic, social, civic, social-civic, or vocational. If the learner can profit sufficiently to warrant his being given further general or special training, it should be offered him. (3) Varied curricular reorganization is very necessary. Many advantages are derived from a variety of teaching procedure.

The common school has been constructed largely on the theory that children are closely similar in their abilities, type of mental make-up, and special capacities. These assumptions are all false. Children can be grouped so that their abilities, interests, and social needs will be more nearly homogeneous. This will tend to improve their social environment in school. Even after the school has provided for as great homogeneity as possible there is still a wide range of individual difference within the group with reference to the trait considered. The teacher should recognize this difference.

One of the greatest causes of educational error has been the assumption that all children are seeing, thinking, interpreting, and understanding through the same media. Such is not the case. Each is seeing, thinking, and learning through the medium of his own habits, attitudes, ideals, and social background. The teacher is caused through this assumption to expect children to understand in the same way that she understood. The

¹ The term curriculum as here used includes all the educative situations to which pupils respond.

teacher would proceed very differently in many cases if the forces which have entered into the child's understanding and attitudes were adequately recognized.

Another feature of individual difference not ordinarily recognized by the teacher is the difference in response to school situations due to differences in health habits and practices. Some children are suffering from physical handicaps. More than we realize are affected in varying degrees by health conditions. The wide variation in the kind, quality, and amount of food provided for these children in the different homes is enormous, to say nothing of the many other factors which have caused individual differences. The children by and large who have the best inheritance are provided with the best environment and care. Those who have the poorest inheritance have correspondingly poor home care. Equal school results under these very different conditions is not to be expected.

Our schools cannot be considered as satisfactorily organized until we have made provision for every child to improve up to the maximum of his capacity. If his capacity is minimized by environmental conditions, the school should function in the improvement of those conditions. The school should not function primarily in causing the mastery of conventional subject matter. It should be considering its achievement in enabling the individual to live happily and efficiently in a rapidly changing environment.

Questions and Problems

1. What is meant by the term individual differences? What biological term refers to the same fact?
2. Make a list of the causes of individual differences. Account for the causes of the differences to the best of your ability.
3. Discuss the proposition that pupils of any given grade are more alike than they are different, that is, similarities outweigh dissimilarities.
4. What recognition should educators make of the fact that pupils are different in important respects?

5. How have modern schools attempted to adjust their curricula and methods to meet individual needs?
6. Discuss the proposition that teachers should consider individual differences as an asset rather than a liability.
7. To what extent should educational and vocational counselors take individual differences into consideration?
8. Should the classroom teacher expect all of her pupils to attain standard norms in each school subject? Why or why not?
9. Is it possible to measure the amount of likeness or difference in traits between individuals or groups? If so, how?
10. To what extent does race condition an individual's ability to learn?
11. Speech defects are commonly encountered in every school. What is the obligation of the school to pupils having this defect?
12. To what extent should school administrators recognize individual differences among the teachers? Discuss fully.
13. Should ability to do the work of the next grade be the sole criterion for promotion? Discuss fully.

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CHAPTER VII

HABIT

THE term habit literally means a garment, or a form of life, a mode of conduct not naturally having grown out of the body but put on from without. Teachers and students of education are accustomed to think of habit as a traditional term of real meaning, but the exact origin of a habit is not commonly discussed. The studies of Pavlov give us the modern explanation.

The laws of the association of ideas have been known; but it has been discovered that when sensations, such as of taste and sound, occur simultaneously, they too may become associated so intimately that their stimulus may produce the same response as the original stimulus. For example, if a dog is given a piece of meat, a secretion of saliva results. The stimulus of the taste and odor of meat is followed by the secretion of saliva as a response. This is an ordinary medulla reflex. If on every occasion when the dog is fed, a certain bell is rung, in the course of time the ringing of the bell becomes associated with the piece of meat so that without giving meat the ringing of the bell will cause saliva to flow. The sound of the bell produces the same physiological reaction of the gland.

In order that this intimate association be formed between any such indifferent stimulus and the original stimulus of an organ, that indifferent stimulus must be associated many times with the original stimulus. The result is a conditioned reflex. The medulla reflex is inherited, but the conditioned reflex is acquired. The student should note that an ordinary reflex is an unconditioned reflex; and the reflex resulting from an associated stimulus is called a conditioned reflex.

The Formation of Habits. The origin of habits is similar to that of conditioned reflexes. Both are formed either by repetition or by an intense initial reaction. "Habits are systems of conditioned reflexes" and "all conditioned reflexes are potential habits."¹

The Psychology of Habit.² The formation and modification of habits comprise the larger part of the educative process. Our motor impulses or actions are either voluntary or involuntary. The lower nerve centers situated mainly in the spinal cord are responsible for the involuntary — the reflex and the instinctive responses, while the higher nerve centers located in the brain are responsible for the voluntary responses. The highest mental processes, such as deliberation, reason, choice, and rationalization, center in the cortex. The circuit of the stimulus leading to an involuntary response would represent the sensory and the motor processes in the lower nerve centers. The sense organ of touch, for example, located in the skin would receive the stimulus; and an afferent nerve fiber would then take that stimulus to the spinal sensory cell. The connecting fiber would transmit it to the spinal motor cell where it would become a motor impulse, and an efferent nerve fiber would carry the impulse to the muscle for its response.

The circuit in case of the voluntary responses is much longer and requires the use of the higher as well as the lower nerve centers. In case of an involuntary response, not more than one-tenth of a second is required, while with a voluntary response one-fifth of a second or more is required.

Basis of Habit.³ Behaviorists describe habits as reactions modified and improved by repetition and experience, that is, any mode of acting not belonging to man's hereditary equipment. A habit is defined as "a complex system of reflexes with functions in a serial stimulus." Watson presupposes some original drive or compelling activity such as hunger.

¹ Burnham, *The Normal Mind*, p. 171.

² Horne, *The Philosophy of Education*, pp. 62-63.

³ Dresser, *Psychology: Its Theory and Application*, pp. 38-40.

The basis of habit according to James is in plasticity, in "the possession of a structure weak enough to yield to influence but strong enough not to yield all at once." "Paths" are formed especially in nervous tissue of the brain by successive impressions. Primarily and originally, habits must have resulted from impulsive or reflex responses. In strictly voluntary responses there is an idea, perception, and volition, but in habit mere sensation is sufficient.

Elimination of Useless Movements.¹ Contrasting the earlier from the later stages of the learning process, a much larger number of superfluous movements characterize the former. Some of these movements are merely useless, while others actually hinder progress. From habitual responses almost all of these have been eliminated. Habit formation consists first in the selection and fixation of essential motor elements, and second in the gradual elimination of those which are useless.

Habit Versus Instinct Tendencies. Habit is distinguished from instinct by being acquired, not inborn. In a habit, nerve connections have to be made by exercise and satisfaction. A boy has to learn to dive, and the nerve connections which ultimately coördinate his muscles have finally been brought to a state of readiness by long practice, by annoyance at failures, and by satisfaction at successes. Diving becomes an acquired skill. Not only may habits develop directly from instinctive tendencies but also from the conflict of instinctive tendencies.

The term habit is most frequently applied to all skills, moral or immoral, desirable or undesirable. We may say that a boy dives or writes badly because of bad habits acquired when he was first learning. There is no reference here to good or bad habits, but rather to the way in which all habits are acquired.

An animal possessing quite fixed, definite, strong reaction to respond to a given situation in a given manner cannot easily form any specific habits in response to that situation. A sheep

¹ Angell, *Introduction to Psychology*, pp. 54-55.

has a tendency or pattern reaction to feed on the hillside while cattle on the other hand prefer lowlands. It would be tremendously difficult to cause either to respond differently to the pasture situation. But if an animal does not always respond in quite the same way to a situation, habits can be formed quite different from the responses due to instinct, out of which they are developed. By instinct the dog attempts to jump a fence, but sometimes it is easier to crawl under it. He can be trained always to crawl under by rewarding him for crawling under and punishing him for the jumping response. Variability of response makes training or learning possible.

In the early stages of the development of a particular skill such as in golf, one makes wrong responses much more often than right ones for many months or even years. Do not these wrong responses tend to develop habits undesirable on the part of the player? Another law provides for the nullification of these random responses. It is the law of satisfaction or pleasure that comes to the individual upon making a correct response as opposed to the annoyance or dissatisfaction in case of a wrong response. The individual practices more faithfully and regularly according as there is satisfaction rather than annoyance, and more certain is he to do so as the degree of satisfaction increases and less likely as the degree of annoyance increases.

Habit Versus Skill. A specific habit is an acquired tendency to reaction. The bond or connection between the stimulus and response functions automatically or mechanically. A skill differs from a habit, in that the former is relatively complex and the latter relatively simple. Skills are more or less elaborate combinations and integrations of specific habits. In learning to operate a typewriter, for example, the individual must learn which keys to strike with each finger, when to strike them, how to direct attention to the copy material or dictation exercise, etc. Each of these may be considered as a specific habit, but an integration of these specific habits constitutes a highly complex skill.

Significance of Habits.¹ The savage is merely habituated. His habits are blind in the sense that they were formed without his knowing what was going on; and they are largely motor. On the other hand civilized man possesses habits both motor and mental affecting his intellect, his emotions, and his whole disposition.

Habit does not wait. It seeks occasion to pass into full operation, and is often identified with mechanical or external modes of action to the neglect of mental and moral attitudes. Habits reduce themselves to routine ways of acting or degenerate to the degree that intelligence is not operative in their activity. Routine habits are sometimes called unthinking habits. Bad habits are those so separated from reason that they opposed the conclusions of conscious deliberation and decision.

Habits are expressions of growth. They mechanize and facilitate reactions, causing them to function more efficiently. They free the attention from the process. After a habit has become thoroughly fixed the response becomes automatic. To project attention into the activity normally performed, at that stage, interferes with the response. The senior student, for instance, on commencement day walks very awkwardly across the platform before the audience. His self and social consciousness interferes with his walking habit. Habit lessens fatigue, makes possible a greater accomplishment per unit of time with a lower expenditure of psychophysical energy, and at the same time increases accuracy. All processes that occur repeatedly and without variation should be habituated. Habits are good to the extent that they make judgment more effective by looking after details that are unvarying.

Laws of Habit Formation. The laws of habit formation associated with the names of Bain, James, and others have been restated and supplemented by Thorndike. All of the changes in man's thoughts, feelings, and actions take place according to certain fundamental laws. Proceeding on the assumption that

¹ Dewey, *Democracy and Education*.

all learning is identical with education and habit formation,¹ the laws of habit formation are identical with the laws of learning.

The Law of Readiness. The sort of learning named connection-forming, associative memory, association, and habit-formation "is an obvious consequence of the laws of readiness, exercise, and effect." When one has a real motive, urge, or drive for the mastery of a certain habit or group of habits, and is well acquainted with the progress he is making toward that achievement, he is ready to respond to that situation. For him to do so is satisfying. For him not to do so is annoying. Suppose conditions were not so favorable and that he were not ready to respond. For him not to do so would be satisfying; for him to respond would be annoying. This is an illustration of the law of readiness.

The Law of Exercise. The law of exercise comprises the laws of *use* and *disuse*. When a modifiable connection has been made between a situation and a response, the strength of that connection is, other things being equal, increased. By the strength of the connection is meant roughly the probability that the response will be made again when the situation recurs. This is the law of *use*. "When a modifiable connection has not been made between a situation and a response during a length of time, that connection's strength is decreased." This is the law of *disuse*.

At the annual meeting of the American Society for the Advancement of Science, held in Nashville, Tennessee, December, 1927, Dr. Knight Dunlap of Johns Hopkins University referred in his paper to the effect of "negative factors" in habit-formation. There are known cases in which the situation-response bonds are weakened in spite of repetition of the response. Repetition has in itself no effect, but is important in that through

¹ All learning worth while is educational and does modify behavior for good. But not all learning is worth while. Much of it has no favorable influence on behavior.

it certain positive factors may have their chance to operate. Should the individual be merely repeating the response, not only without any interest in improvement, but with decided ambition to rid himself of the tendency to make that response, negative factors rather than positive would be operative and the effect would be according to the law of disuse described above.

Dr. Dunlap raises the question whether stammering can be cured by causing the patient to stammer voluntarily in as nearly as possible the same way in which he ordinarily stammers. He proceeded to test the theory on himself in the effort to rid himself of the habit of writing "h t e" with the typewriter instead of disarranging the letters. He deliberately filled half a page with the combination "h t e" with the thought that this was a "word" that he would not write in the future except voluntarily. A week later he repeated the experimental misspelling. Now he is cured.

The Law of Effect. When a modifiable connection is made and accompanied or followed by satisfaction, the connection's strength is increased. When it is accompanied or followed by annoyance, the connection's strength is decreased. The strengthening effect of satisfaction or the weakening effect of annoyance varies with the closeness of its connection with the bond.

Professor Thorndike gives also two general rules: (1) "Put together what should go together and keep apart what should not go together. (2) Reward desirable connections and make undesirable connections produce discomfort." The law of habit is often stated as "practice makes perfect." The law thus stated is not true. Practice without zeal, with equal concern for either success or failure does not make perfect.

Beside the laws of readiness, exercise, and effect operating in human associative learning, there are the subsidiary laws: (1) the law of multiple-response; (2) guidance by a total attitude or set; (3) prepotency of elements; (4) response to new

situations in accord with already existing bonds; and (5) the shifting of bonds by progressive changes in the situation. These same laws are revealed in animal learning.

By multiple-response or varied-reaction a child may, of the various possible responses, learn to make the right response at first. In many cases as the first steps in learning he may make varied responses before the right one is established as a habit.

The second subsidiary law, that of guidance by a total attitude or set, is a general law that the response made is determined by the condition of the learner as well as the nature of the situation. The condition of the learner may be rather permanent or more temporary or shifting with varying attitudes and sets. The same situation may not appear the same on two successive occasions.

By the law of prepotency of elements some one element or another may have prepotent strength in the learner's mind at the time. He will then respond to that element rather than to the situation as a whole. His response may be determined more by his idea of the meaning of the situation than by the real situation. A common brick is 8 inches long, 4 inches wide, and 2 inches thick. This statement when made orally causes the hearer to have a prepotent idea "brick." On being asked "How many bricks in a stone wall eight feet long, four feet high, and two feet thick," the learner will probably start to figure out the problem. On being asked how many two cent stamps in a dozen, the learner is likely to respond, "six."

The law of response to new situations in accord with already existing bonds is illustrated by the effects upon response of more permanent attitudes or sets. To the situation "a sleigh-ride party," an Englishman, or Italian, lover, painter, father of a family, or celibate, will respond in a widely different manner from perhaps any of the others. "The attitude or set of the person decides not only what he will do and think, but also what he will be satisfied and annoyed by."¹

¹ Thorndike, *Educational Psychology*, Vol. II, p. 25.

The law of partial or piecemeal activity or associative shifting is largely the result of the shifting of satisfyingness and annoyingness. One may become unhappy and even wretched by outdoor sports, by high life in a large city, or by his daily occupation. One person will try to commit suicide when he gets down to his last million, while another would think life worth living if he had that much. Any response may be attached to any situation providing the individual is in the proper frame of mind and is capable of making it.

General Principles in Habit Formation.¹ Certain general principles in habit formation prominent in the older psychology texts apply to all modifiable reactions. They are involved in the acquirement of all skills and habits. We shall attempt only to summarize them.

First Principle: Primacy. The probability that a situation will arouse a response which it has once aroused depends upon the primacy of the last response. Other conditions being equal, first responses that were made are longest retained and remembered. Many responses and events of early childhood are retained in memory long after more recent responses are forgotten. First impressions seem to be more lasting ones possibly because of the frequency of repetition, the vividness of the impression, or the emotional accompaniment of that response.

Second Principle: Recency. The probability that a given situation will arouse a response that it has once aroused depends upon the recency of the last response. Other conditions being equal, the shorter the time which may have elapsed since the last response, the stronger the bond.

Third Principle: Frequency. The supporters of this principle considered that, other things being equal, the more frequent the response, the greater the probability that the response would be made when the situation recurs; that the tendency to respond becomes weakened with the passing of time. This is what Thorndike calls the law of exercise, which has

¹ Dunlap, *The Elements of Scientific Psychology*, pp. 223-230.

already been described. It may be that neither the principle of frequency nor the law of exercise is operative except when the individual exercises for the specific purpose of improvement, or when he has a real interest in improvement. The reader is referred to "negative factors" under the law of exercise.

Fourth Principle: Vividness. The higher the degree of attention given to the stimulus or situation or the more potent the stimulus the greater the probability that the response will be made again, other things being equal, when the situation recurs. Inattention or weakness of a stimulus seriously affects the formation of a habit. Neurologically, the fixing of a reaction pattern depends upon the coördination of the nervous system involved in the reaction. The more complete the coördination by the pattern involved, the more lasting the situation-response bond.

Fifth Principle: Emotional Tone. Stronger feelings and emotions facilitate the formation of habits by increasing the strength of the bonds, by fixing the reactions with which the emotion is connected, or by inhibiting the fixation of conflicting reactions. All types of emotion, pleasant and unpleasant, have this general effect. Reward for right responses and punishment for wrong responses are effective under certain conditions. Thorndike includes reward and punishment in his rule for habit formation. "Reward desirable connections and make undesirable connections produce discomfort."¹ When emotions are directly connected with the responses they are intended to fix or eliminate, there is little doubt of their positive effect. On the other hand when emotions become connected with other than the particular reaction to be habituated, they interfere with the learning process. For example, the child who is cowed by threats of failure or who has lost the confidence of his teacher cannot do his best work. His attention is associated with fear of punishment rather than with possible reward for learning. The effect of these threats, however, desirable or

¹ Thorndike, *Educational Psychology*, Vol. II, p. 20.

otherwise, depends upon the associated emotion which is aroused in the individual.

Burnham¹ states that habits like conditioned reflexes are formed by repetition or by shock, that is, by an intense initial reaction.

Sixth Principle: The Limits of Mechanism. The extent of achievement in a mental function is limited by the inherent characteristics of the nervous system. Here again the relative limitations are to some extent determined by individual difference as to the particular trait. These limits depend somewhat upon heredity, which determines the general character of the human mechanism upon the rapidity of the metabolic process, and upon the degree of perfection in health. Learning and habit formation are highly dependent upon general physical conditions, nutrition, fatigue, glandular disorders, chemical factors, and social relationships. The individual will make greater progress when working in a well-organized group than when working by himself. We should not conclude that the learner has reached his limit just because he does not improve.

Seventh Principle: Implicit Habits. The occurrence of a habit reaction may prove the existence of that habit, but its nonoccurrence does not prove its nonexistence. A habit that functions by enabling the individual to make the habitual response is called an *explicit habit*. If it is latent, present but not functioning, it is called an *implicit habit*. One may fail to recognize a person or situation with which he has earlier been entirely familiar. The habit appears lost but may reassert itself upon the presentation of the proper stimulus.

Implicit habits require but little further repetition to cause them to become explicit. Habits apparently lost or forgotten do not require the same amount of effort to renew them that was originally required for their formation.

Eighth Principle: Parsimony. As pointed out by James and others, as many useful acts as possible should be made habitual.

¹ Burnham, *The Normal Mind*, p. 172.

Acts of this kind are performed with a minimum expenditure of energy. Thought being required in performance, energy is needed both for the thought and for the act; and when we respond automatically, energy for the act only is required. By the law of parsimony consciousness tends to desert those processes where it is no longer needed. This means a saving of energy and is contributive to accuracy and reliability. "We make no mistakes in coördinations which have become automatic."¹

Rapidity and Accuracy in Habit Formation. It is not advisable to be hasty to form habits. In every stage of learning there is a point beyond which too great rapidity will be the source of many errors. It is desirable to "speed up" for the sake of the habit of industry; but it is unfortunate to use speed at the expense of accuracy in performance. The reader should not at this point confuse rapidity in habit-formation with rapidity in the exercise of a function already habituated. In such a case, greater rapidity of action seems to contribute to accuracy.

But slow learning does not guarantee that the work will be done carefully. Many pupils learn slowly because of inattention and indolence. These should be stimulated to work more rapidly. Each pupil should be studied to determine the conditions under which he can work best, and he should be placed in a group where all the pupils are most nearly like him in this particular trait.

Principles Utilized in Developing Habits.² The first principle is *motivation*. In order to develop the desired habits economically the teacher should explain to the child the purpose of the experience, how it will help him to meet new problems and situations. In past years we have heard a great deal about "problem methods" and "project methods" as a means of causing the child to be active along lines seemingly essential. To have him work, and to have his various activities motivated is a necessity. But is there not an analogy between the old "sugar

¹ *Ibid.*, p. 181.

² Bagley and Keith, *Introduction to Teaching*, pp. 219-223.

coating" idea and motivation? There seem to be two ways of motivating: (1) artificially, and (2) naturally. It is artificial to present a problem in a manner that makes it look fairly good, no matter what ails the child. It is natural motivation to present problems for the solution of which he sees immediate need and use. Such problems do not need motivating in the traditional sense. The fact that we still try to develop habits and skills for which the learner has no immediate need is evidence to the effect that we are still influenced by the idea of "formal discipline."

The second principle is *focalization*. Habits and skills can be built most efficiently when there is conscious direction in the early stages of development. Focalization really means getting a clear idea of how the different muscles must work together to form a habit.

Habits may also be initiated by the "trial and error" process. The individual thus blunders along until he finally hits upon the right combination of movements. This method is of greater importance in education than has been estimated. Those who have referred to it have generally had in mind individual habits only. There are group habits as well as individual habits, and our social habits are developed perhaps wholly by error and adjustment. Because of so many and varied points of view it seems quite impossible to secure adequate focalization.

The third principle is *attentive repetition* accompanied by a desire or determination to succeed.¹ A habit cannot be formed without repetition except when a response to a situation is accompanied by intense emotion or "shock." Mere repetition without interest in either direction, for habit-formation or for habit-elimination, is not effective. The learner *must* be conscious of his mistakes and successes, and it is very important that his successful efforts shall be recognized and rewarded.

The fourth principle is *permitting no exceptions*. In estab-

¹ As mentioned elsewhere, attentive repetition must be accompanied by a desire to get rid of the habit. This method seems to be successful.

lishing a new habit, especially when it displaces an old habit or is strongly opposed by original nature, it is essential to permit no exception to the activity required by the new habit, and especially that there be no relapse to the old habit or to the instinctive response. This principle is important in all phases of habit-formation, but particularly so in connection with so-called "moral" habits.

In the application of this principle to education, the number of habit-building processes of the same sort undertaken at about the same time should be reduced to a minimum. In spelling, only two or three new words should be taught at a time, and with adequate focalization until they are mastered. In a rather extensive research problem, it is economy to pursue only certain phases of the problem (preferably one) at a time. With the proper references at hand for the major part of the problem, this is possible.

A fifth principle to be utilized in developing habits is *interference*. During the process of formation, habits may conflict in certain of their elements. Many textbooks of education suggest the notion that skilled performance is built up from a series of more or less discrete partial responses and that these partial responses are fused together as a result of practice. Ogden has found reason to believe "that a total-response of the entire organism precedes any differentiation of partial activities, either in the phylogenetic series that accounts for the evolution of reflexes, or in the ontogenetic course of forming habits."¹ This being true, the acquisition of a habit is not a combination of distinct acts already possessed by the learner, but the creation of a new form of response.

Thorndike says: "What happens to any one bond makes differences to other bonds in the same man that it does not make to those bonds in a different man."² At the time of beginning the acquisition of a new habit one is already in possession of

¹ Ogden, *Psychology and Education*, p. 141.

² Thorndike, *Educational Psychology*, Vol. II, p. 350.

many bonds which have elements identical with certain elements of the newly forming habit. The strengthening of one habit produces a similar change in another when they are in part identical.

Suppose one has trained for an hour on a standard keyboard typewriter, the keys being arranged in the following order:

Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M

If he were then to practice for an hour with a special keyboard with keys arranged to the order:

A C B D F E G I H J
L K N M P O R Q S
T V U X W Z Y

on returning the third hour to the standard keyboard he would do worse at the beginning. But if he were to practice one hour a day on each machine he would become able after twenty hours of practice on the two machines to turn from one to the other system of bonds readily, and he would probably find that the two alternate systems give greater ability at either than ten hours of practice on one machine alone. However, if the individual is to use a standard keyboard machine, to practice on both is a clear case of interference and loss by spending twenty hours to attain greater ability than ten hours would render on one machine.

We may refer to the subject of arithmetic for illustrations of wasteful and harmful habits. In a certain school system a supervisor of upper primary grades advises multiplying by 11 and 12 in the same manner as by the one-place numbers 2 to 9 inclusive. Such habits interfere with two-place multiplication and should be left to the pupil to acquire by himself as he needs

them.¹ "The elaborate emphasis of the supposed fact that we cannot multiply 726 by 8 dollars and the still more elaborate explanations of why nevertheless we find the cost of 726 articles at \$8.00 each by multiplying 726 by 8 and calling the answer dollars are wasteful. These imaginary difficulties should not be raised at all."²

Burnham³ has reminded us of additional interferences of habits. Useless habits, which seem to be broken up, remain latent, ready to interfere with new habits at the first opportunity. "The countryman would quickly learn city ways if he could forget his rural habits."⁴

Watson found that after a rat had mastered the maze, or had just learned to eliminate all errors, he could be depended upon to work with steadiness "unless some disturbing sound was made while he was passing some important turn in the maze. If even a slight noise were made at such a time, he would make a serious error, and unfortunately, this error was made on the succeeding trips at the same place again and again. If one such error were made, the connectedness of the whole series of movements was likely to be interfered with — the animal would get hopelessly lost. When in this condition, there was nothing left to do but to put him back in his cage and let him 'sleep it off'."⁵

Breitwieser⁶ finds that interference in muscular activity is rarely ever introduced in the accurately habituation reaction.

The Practice Curve and Its Plateaus.⁷ The rate of improvement at the outset of forming a new habit is very rapid. With the same amount of effort the rate of improvement becomes less and less until the limit is reached. At times there

¹ Probably he will never need these habits.

² Thorndike, *The Psychology of Arithmetic*, p. 85

³ Burnham, *The Normal Mind*, pp. 192-196.

⁴ Jastrow, *The Subconscious*, p. 549.

⁵ Watson, J. B., "Animal Education." *University of Chicago Contributions to Philosophy*, Vol. IV, No. 2, 1903.

⁶ Breitwieser, *Psychological Education*, Chap. IX.

⁷ Colvin and Bagley, *Human Behavior*, pp. 175-179.

are periods when no improvement is evident, at others there seem to be actual reductions in achievement. In the series are found periods of growth, periods which indicate absence of growth, and periods indicating actual depression. The practice curve ¹ is a graphic picture of this achievement series from the beginning of practice until the habit has been more or less perfected. The flattened places on the curve, representing neither gain nor loss of growth, are known as *plateaus*.

Plateaus may represent periods of slow growth, no growth at all, or simply periods of reorganization. They may be due to a condition of being bored, or to fatigue. If the former, the probable cause might be seeing little or nothing new to keep up interest in the activity. Such periods are critical for the learner, since he is likely to become confused or discouraged and his morale may lower below the point essential to growth.

In nearly all habit-formation, initial practice is interesting because of novelty, and very productive of achievement. One gradually approaches the period, however, where progress is retarded more and more, owing to increased difficulty. After passing a plateau, improvement usually seems relatively sudden for a time. This change is accompanied and caused by changed attitudes on the part of the learner.

It is controversial whether plateaus in the practice curve are essential, and whether they could be avoided if proper precautions were taken. It is entirely possible that with improved technique in teaching these flattened places on the curve would partly disappear, and that no actual relapse periods would appear. At all points the learner should be more conscious of his improvement status, and of his difficulties and how they can be reduced or eliminated. He should not be allowed to reach the point of serious fatigue. Practice periods should be interspersed with rest periods according to the nature of the practice. The learning should be with carefully organized material and by graded steps arranged according to the general

¹ The student is referred to the same topic in the chapter on "Learning."

ability of the learner. His ability to achieve should be a basis for the amount to be expected per unit of time and for encouraging him toward intensity of effort.

Permanency of Habits. It has been pointed out that habits are conditioned reflexes at the outset; that a habit is a series of conditioned reflexes. But "conditioned reflexes, in contrast with the unconditioned reflexes, are unstable, temporary, always tending to die out if not reënforced by association with the unconditioned stimulus, and subject to inhibition by any chance stimulus from the environment."¹ How, then, are habits so permanent?

First, conditioned reflexes themselves are sometimes permanent and stable when the initial association has been accompanied by intense "vividness," or what may be called "shock." An elephant will not cross a bridge where there is the least danger of breaking through. This habit might be considered an unconditioned reflex, but in all probability a conditioned reflex really exists and it is permanent. Many people abhor and avoid dogs. When a dog runs out suddenly and barks or growls, a chilly sensation is felt over the entire scalp. Such people have probably been bitten by dogs and the habit of fear is often permanent. A horse may have become very much frightened, when a colt, at something by the side of the road. Thereafter it will shy at any small object, such as paper. The horse may have been ruined by a single unfortunate association. It is easy to prevent such associations, but very difficult to overcome their influence.

In the training of animals a mistake on the part of the trainer may spoil the animal; but with children, if there is carelessness on the part of the parent, or a poor teacher, or an unfortunate situation in the child's environment resulting in perhaps a lasting mental injury, we are likely to call the child defective or feeble-minded.

Then again, an intense association may be followed by many

¹ Burnham, *The Normal Mind*, p. 161.

repetitions. Then there is a twofold cause of a conditioned reflex which remains permanent. Children delight in repetitions of associations especially those accompanied by strong emotion.

Older psychologists were impressed by the permanence of one's habits. William James was certain that generally after the early twenties one's habits are definitely and permanently formed, that only along these lines can new habits or thoughts occur, and that one can no more escape these habits than one's clothes can fall into a new set of wrinkles.¹ Modern studies, however, suggest methods of forming new habits in place of the old, even though habits are considered almost permanent and imperative.

Automatization. Years ago writers were impressed with the advantages of forming as many habits as possible from daily activities, and of making learning automatic. Automatizing a great number of the routine activities and intrusting them to the functioning of the lower centers and the spinal cord would relieve the higher centers of the brain for more important matters.

The value of automatization is unquestioned, but the possibility of transferring activities from the cortex to lower centers as a result of practice is questioned. Lashley's studies of white rats show that even with a thousand repetitions, visual motor reactions are not transferred from the cortex to lower centers. In animals that "were trained in the habit of visual discrimination and were then given additional practice for 1200 trials, destruction of the visual area resulted in the loss of the habit."² "Long training does not transfer the habit, to sub-cortical centers, but it must be functioned, if at all, by a conditional reflex arc."³

¹ Reported by Burnham, *The Normal Mind*, p. 173.

² Lashley, K. S., "Studies of Cerebral Function in Learning." *Journal of Comparative Psychology*, Vol. I, pp. 453-468, 1921.

³ Burnham, *The Normal Mind*, p. 180.

Nature of Automatization. If certain kinaesthetic motor habits are being functioned by lower centers, this fact was determined at the time of learning. If the functioning was promoted by an ordinary reflex arc through the lower levels at the time of learning, it remains such; or, if it were a conditioned reflex arc or cortical at the time of learning, the relationship remains unchanged. "Thus automatization, whatever its neurological basis may be, is not to be explained by transfer from higher centers to lower."¹

Hierarchy of Habits. Habit in its simplest form is but a sensorimotor coördination. More complex habits are groups of coördinations. The acquisition of proficiency in a school subject or in typewriting involves the formation of a hierarchy of habits. Perhaps Bryan and Harter² first referred to a hierarchy, but Book and Swift in their studies of learning found a hierarchy of habits to be involved. While views differ as to what constitutes a hierarchy of habits, the fact remains that a hierarchy does exist. Thorndike says: (1) "There is a certain number of habits which are elementary constituents of all the other habits within the hierarchy. (2) There are habits of a higher order which, embracing the lower as elements, are themselves in turn elements of higher habits, and so on. (3) A habit of any order, when thoroughly acquired, has physiological, and, if conscious, psychological unity. The habits of lower order which are its elements tend to lose themselves in it, and it tends to lose itself in habits of higher order when it appears as an element therein."³

Persistence of Lower Habits. In all types of individual learning we probably have hierarchies of habits. Habits of the lower order may persist and cause interference of association. When certain habits have been superseded by better habits the

¹ *Ibid.*, p. 180.

² Bryan, W. L., and Harter, Noble, "Studies on the Telegraphic Language: The Acquisition of a Hierarchy of Habits." *Psychological Review*, Vol. VI, pp. 345-375, 1899.

³ Thorndike, *Educational Psychology*, Vol. II, p. 95.

old ones tend to recur at every relaxation of attention. This tendency can be overcome by persistent and strenuous attention to see that only the more useful habits are permitted to function. The interference of two habits is noted when "short cut" habits are formed for arithmetical processes. Care is required to avoid dropping into the older and slower method, the older bonds being stronger at first.¹

Unconscious Habits.² To the psychologist, habits are largely forms of reaction which function unconsciously, and which we become conscious of only by some unusual experience. Their quality, good or bad, is but a subjective matter. We have various groups of habits, such as habits for preparing for the day before breakfast, habits in our sleeping room, habits for the doors through which we pass, habits at the study desk, and the like. Of many of them we are entirely unaware except as something unusual causes us to realize them.

General Versus Specific Habits.³ Habits, like instincts, are advantageous when conditions under which they function remain unchanged. But under modern conditions of living most intellectual workers waste much energy and time with improper habits of work. Habits of work developed in the nineteenth century are entirely inadequate today.⁴ We were taught many things then which are not done at all today. We need training to discriminate between the essential and the trivial. But what is essential for one is not necessarily essential for another.

It is necessary in early life that generic rather than special habits be acquired. Conditions for generic habits are less likely to change. It is more beneficial to train children to be thrifty and economical about a few things than to train them to save everything with the idea that it may be useful sometime.

Obsolete Habits. The enormous waste of energy due to

¹ Book, *The Psychology of Skill*, pp. 97, 129.

² Burnham, *The Normal Mind*, pp. 175-176.

³ *Ibid.*, pp. 190-192.

⁴ Payne, E. George, "Education and Social Control." *Journal of Educational Sociology*, Vol. I, p. 141, November, 1927.

obsolete habits which have survived changed conditions of life is a matter of supreme concern to health. They not only are obsolete, but they are antagonistic. To a very large extent children acquire the habits of their parents, such habits having been brought to this country from foreign soil. These family habits, by constant repetition of responses, become dominant in the next generation. They are bound up with traditions, beliefs, customs of a very obsolete nature. No wonder, then, that so many people coming from perhaps rural Europe to urban America, who continue their useless habits, are incapacitated through illness and general physical unfitness for efficient living or even normal survival. How unfortunate for children required to live in the resultant immediate environment!

Without question one's physical and mental health is determined not so much by community health activities, as by individual health habits. As mentioned elsewhere, education is adaptation to one's present environment. We must have habits suitable to self preservation, and adequate living today. Until perhaps within the last five years, little or no effort has been expended toward the development of adequate habits of individual living. Even today the need for education as defined above is not generally realized. One city principal recently stated that he did not believe in health education.

HABITS AND EDUCATION

Education and Habit-Formation. Conditions in the world change and change rapidly regardless of the fact that we have many forces tending to prevent them from changing. As soon as habits become antiquated and out of harmony with these inevitable changes, either new habits must be substituted or the conflict between one's habits and his environment will eliminate the individual. One cannot survive without adjustment and adaptation. The greatest human need, then, is adaptation, and unless education provides this adaptation or change in be-

havior, it is worthless. Years ago one could jay-walk up Broadway in New York in perfect safety. Today the same behavior, if undisturbed, will render him incapable of saluting an undertaker. Or, if one fails to render himself immune from certain diseases such as smallpox, diphtheria, and scarlet fever and utilizes the same habits of old with reference to food he cannot survive. The felt need for more adequate habits is gained through education and that only. Education is the cause of the necessary changes in behavior.

We hear flattering reports about people living longer today than perhaps in 1890. Such notions are very misleading. The fact that life's expectation at birth based on averages is at least 62 years in 1928 as compared with 41 years in 1890 does not reveal the whole truth. What has caused the change? Education has lowered the rate of infant mortality from perhaps 250 per 1000 births to about 30. Education has greatly reduced the death rate through improved health and safety conditions and practices. As yet it has done little to improve individual practices. Life's expectation for a man who has lived 52 years is about the same as in 1900, namely, 20-21 years. People do not live longer today, and cannot except as they establish adequate habits of living.

Habits as Related to Ideals and Attitudes. Prejudices and attitudes grow out of specific habits, as when habits of Sunday observance, established in early childhood, become more or less established as ideals and later express themselves as prejudices which make Sunday nonobservance produce discomfort and annoyance. Specific habits of cleanliness cause one to idealize health and to develop attitudes favorable to more efficient living. On the other hand, with each new idea there is a resultant new attitude. Attitudes and ideals create a situation conducive to the development of helpful habits. Specific habits promote the development of usages and customs which are themselves habits of groups. The prevalent social attitudes of individuals result largely from these group habits.

"Primary groups are the source of primary social ideals."¹ That is, primary social ideals originate in the experience of these groups. Ideals of love, service, self-sacrifice, and the like originate in the experiences of family life, and experiences are the embodiment of family habits.

Plasticity and Habit. There is a traditional notion that plasticity is a characteristic peculiar especially to the period of childhood, and on this account childhood is the time most favorable for learning and habit formation. There is no real proof of this, however. Professor Thorndike is making a study of this problem and thus far is inclined to suspect that other things being equal, the adult can learn as readily as the youth until the onset of senility. Old age, of course, is not determined by how many years one has lived, but by the extent of deterioration. The period of so-called plasticity is utilized for the acquirement of habits largely because it is not economically useful for anything else.

Arrest of Development. A man is said to be physically as old as his arteries, or as old as his legs; and his age is often gauged by his blood pressure. His blood pressure is increased of course as a result of strenuous exercise, or it may be reduced by careful diet. Arrest of development both physical and mental starts at almost any age. A man at twenty may be older than one at seventy, according to early environment, and training in specific practices and habits. An individual's psychological age may be judged in a similar manner. When one reaches a condition where useless associations persist and cannot be broken up, there is no progress. In the acquisition of skill, habits are formed only to be broken up. The readiness with which one can acquire new habits and adaptations is the measure of mental senility.

Unlearning. In teaching normal individuals we can avoid teaching positive error and direct training in erroneous habits. But the fact that teachers are trained to do a good piece of work

¹ Ellwood, *Psychology of Human Society*, p. 123.

at one time does not guarantee that they will change with changing conditions and restrict training to habits not erroneous. Ideally all erroneous reactions should be avoided; but however desirable they are, and however necessary, no human being can devise a program which will conform to these ideals. It must be remembered also that the school is but one of the many educational agencies, and through the efforts of any one of these, erroneous habits may result. It becomes necessary, therefore, that we study methods of unlearning as well as learning.

"The characteristic of the thoroughly normal child is the ease with which the conditioned and memory reflexes are broken down. In the case of the defective or neurasthenic child the conditioned reflex persists after the desirability of it has ceased, and only with difficulty is it broken down. One of the obstacles in educating the feeble-minded is that it is hard for them to unlearn."¹

Individual Differences in Habit-Formation. There are great individual differences in the facility of acquiring habits. Very likely there is the type of individuals who acquire habits only by the slow process of repetition and the type acquiring many habits by shock or vigorous initial reaction. Within the ranks of either type there is a wide range of variation.

Schools are likely to favor certain types of learning. A pupil employing a somewhat unusual method of learning is likely to be a misfit in an ordinary class. The unconventional type of learner is likely to be actually spoiled by the process employed. His initiative may be retarded and his ability dulled by unfortunate habits.

The individual very susceptible to suggestion apparently belongs to the type which learns essentially by shock. The suggestion really suggestive is always a shock and it brings a similar reaction. With him the method of repetition is worthless. It is possible that grouping pupils homogeneously more nearly according to the type of learning employed would be a solution

¹ Burnham, *The Normal Mind*, p. 184.

to the problem. Just what relation exists between ability to learn rapidly and the method employed is an interesting problem.

Sequence in Acquisition of Habits. There being a hierarchy of habits, it is important to follow right sequences in the acquisition of habits related to a given subject. This is a field requiring much investigation and study. Professor Thorndike has kept the idea of hierarchy to the front in his *Psychology of Arithmetic*. He says: "When the problem of teaching arithmetic is regarded, as it should be in the light of present psychology, as a problem in the development of a hierarchy of intellectual habits, it becomes in large measure a problem of the choice of the bonds to be formed and of the discovery of the best order in which to form them and the best means of forming each in that order."¹

Habits for Every School Subject. Psychologists used to talk about "ability"; but for some years the preferred term has been "abilities." Likewise not only every subject, but every phase of the subject has to do with a great number of habits. Only by trained introspection and by experimentation can all the elemental habits involved be isolated, in a gross situation. For years it was supposed that there were but 45 addition combinations. Later 100 were found. Adding downward involves one habit or set of habits, and adding upward involves another set.

Habits to Be Formed in Supervised Study. "Study habits necessarily vary with the nature of the subject. The teacher must discriminate between general study habits and those relating only specifically to the particular subject. Thus in mathematics the following are particularly important.

1. "The habit of making a mental summary of what is given in a problem and what is to be found.

2. "The habit of getting and holding the conditions of the problem in general terms — to avoid the extra effort and confu-

¹ Thorndike, *The Psychology of Arithmetic*, p. 70.

sion which result from holding involved verbal statements and wrong numbers in mind.

3. "The habit of deciding, before making the computations, what you will do with a partial answer when you get it.

4. "The habit of deciding whether the answer 'when found' seems reasonable before going through the actual proof. In the field of history we find such habits to be developed as:

- a. The habit of forming moral judgments.
- b. The habit of forming accurate chronological judgments.
- c. The habit of suspending judgment until all possible facts are at hand.
- d. The habit of critically evaluating data and evidence.
- e. The habit of generalization and application.
- f. The habit of demanding objective as opposed to subjective data.
- g. The habit of securing verifiable data and records.
- h. The habit of demanding impartial data.
- i. The habit of citing expert opinion when objective data cannot be secured."¹

At present pupils are generally being found weak in subject matter, but too little attention is being given to the more probable causes. Compelling pupils to study under the guidance of the teacher is but providing a new environment and does not imply greater achievement. It is too often "the blind leading the blind." The subject of study has received much emphasis for twenty years, but teachers direct from schools of training often do not know how to study themselves. How can they supervise study? The development of good mental habits is more essential than the mastery of certain subject matter. In fact, the mastery of subject matter is not the primary purpose of the school; it is secondary, and even then the question arises whether learning certain subject matter involves education.

¹ Johnson, W. H., "Supervised Study in the High School and the Seventh and Eighth Grades." *Chicago School Journal*, pp. 325-328, May, 1924.

Prevention of Unfortunate Complexes.¹ Thousands of experiences are placed in a child's path which he never should encounter. They are not only not educational but arouse in him certain emotional reactions which are most unfortunate. We are reminded that in order to understand a child, and an adult as well, we should know the social background which he reflects. We need also to understand his emotional background. When a child the writer remembers having been told that a "nigger was in the garret" and for a long time he was afraid to go to sleep in the dark because of some conditioned reflex which had been established by an experience accompanied by intense emotion. Things indifferent to the adult may occasion extreme emotional excitement in the child, and when he is alone or even in company he may be heard to refer repeatedly aloud to that particular occasion. The remembrance of it may never entirely fade.

But while we may know of one such experience, there may be hundreds of which we are not aware. The parent and the teacher can save a child from many unfortunate complexes.

Habits of Thinking.² One of the chief functions of the teacher is the development of analytical thinking habits. Perhaps reflection and judgment activity is one of the most strenuous of all human behavior. This may explain why so few people do any real thinking. "Analysis means breaking the whole into its component parts" and deducing therefrom an understanding of relationships. This evaluation of data which forms the basis for judgment should become habitual. Above all others the teacher is in position to do just this work. Among the desired results, if this were done, could be listed: (1) questioning of such wide generalizations as are prevalent; (2) lessening the tendency to take too much for granted; (3) the setting up of a scientific attitude toward all problems; (4) more thorough knowledge of current conditions; and (5) an increasing

¹Burnham, *The Normal Mind*, p. 175.

²Dearborn, *An Introduction to Teaching*, pp. 71-72.

assurance that controversial problems will be equitably settled. Right thinking habits may be developed by skillful guidance from the beginning of the learning process.

Mistaken Assumptions. Habits will not function in situations other than those in which they are formed. Neatness in arithmetic will not necessarily function with reference to other subjects. Knowledge of rules does not necessarily function in motor activity, nor does knowledge of rules in grammar greatly improve speech. Do not depend upon so much transfer. Doing the work for a child never develops in him the habit of doing it. Helping him too much is only a lesser evil. Permitting careless work is practically training in careless work. Accepting incorrect English is one of the glaring violations of the law of habit-formation for correct English.

"Much so-called laziness in school is caused by the effort of the teacher to establish habits of recognized value to adults but which do not appeal to the child himself. The child usually is inadequately directed, and has but little appreciation of the value of the demands made upon him by his teachers. His lack of attention and concentration with regard to his school work appears in his failure to accomplish his task and he is charged with unsatisfactory work. The assignment is very often likely to be a time-killing exercise of little lasting value to him. The child thus by virtue of his school training acquires the chronic habit of day-dreaming, which minimizes his ability to concentrate upon the task of actual accomplishment.

"The educative process may be the cause of what is called laziness. Normal children in abundant health and vigor possess tremendous energy which seeks an outlet. Inhibition of this activity in such children results in unnatural sluggishness, inertness, or apathy. This often represents the onset of some one of a number of communicable diseases whose first symptoms are expressed by altered behavior. The writer is not at all sure that absence of disease among school children during the summer months is due entirely to weather conditions rather

than to increased vitality resulting from unrestriction and increased freedom of childhood.”¹

Group Habits. As opposed to lower animal groups which are undoubtedly dominated by heredity and instinct, human society is characterized by acquired uniformity due to habit. A habit acquired by one individual may through interstimulation be communicated to other members of the group and thus become common to all. This explains why the social life of man has many complex phases such as industry, art, religion, education, and morality, not shown by other animal groups. “It is culture and habit, not instinct, which must be the main concern of the sociologist, or of any one who offers a psychological interpretation of collective human behavior; for it is the development of culture which distinguishes the social life of man from the social life of the brutes.” Man’s “prolonged period of immaturity means the possibility of greater social control over habits of the individual.”² Human society is based essentially upon habit and intelligence rather than so much upon hereditary changes in organic structure.

Man’s capacity for the acquirement of an indefinite number of habits is the main basis upon which civilization has been built.³

Social usages or folkways are simply group habits, the raw material out of which human institutions are made.

Social customs or the mores are social habits more or less sanctioned by the group in which they obtain.

Questions and Problems

1. What is a habit? Can habits be broken? What is meant by “breaking a habit”?
2. What is the difference, if any, between a habit and conditioned reflex?

¹ Wile, I. S., “Laziness in School Children.” *Mental Hygiene*, Vol. II, pp. 76-77, January, 1922.

² Ellwood, *Psychology of Human Society*, p. 62.

³ *Ibid.*, p. 123.

3. What rules have been suggested for building habits?
4. Habit may be said to have its roots in instinct. Explain.
5. What is the physiological basis of habit?
6. What is meant by the statement that habits "develop by a process of selection from among the diffuse activities which appear whenever there is no definite mode of instinctive behavior which serves as a foundation for development"? (Judd, *Psychology*, p. 200.)
7. Distinguish between habit and skill.
8. What is the rôle of habit in the life of the individual and in society?
9. Give an illustration from some classroom activity that habit requires more than exercise for its formation.
10. Make a list of 20 social habits that children should form.
11. Make a list of 10 intellectual habits that would increase human efficiency.
12. What is meant by a "hierarchy of habits"?
13. In what sense is all learning a matter of habit formation?
14. What are the functions of habit?

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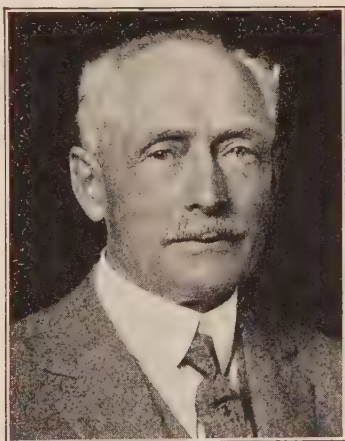
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CHAPTER VIII

THE LEARNING PROCESS

Theory of Learning.¹ "Learning is a process of connecting." It involves both habit-formation and knowledge-getting. In the former, connections are established between responses and their stimuli, in the latter, between ideas.

These connections are either between parts of simultaneous experience or between successive experiences. If I see a person and hear his name spoken at the same time, a connection is made between the individual object and his name. Connections between successive experiences are illustrated in typewriting. The stimulus is realizing the need for typewriting aided by the observation of others who have acquired skill in the manipulation of the machine; and the response is the mastery of the necessary technique. Learning to typewrite is the process of establishing connections between the situation of need and the motor response. With continued practice the resultant satisfaction stimulates the operator to more and more practice until sufficient skill has been acquired.

Not only do parts of experiences become connected, but there is a difference in the strength of those connections. Connections formed between processes of attentive consciousness are stronger than those between processes of inattentive consciousness.

There are various levels of consciousness. One level may require high attention, another level but little attention. There may also be various levels of clearness. Connections formed between processes of clear consciousness are relatively strong,

¹ Pyle, *Nature and Development of the Learning Capacity*, Chap. XI.

while those between processes of consciousness less clear are relatively weak. The bond formed between clear processes of consciousness is stronger than the bond formed at the same time between vague processes of consciousness. Bonds formed between vague processes often disappear immediately or last but a short time. Bonds formed through clear or vague processes of consciousness are illustrated in the teaching $\frac{1}{3} \times \frac{3}{4}$. If the child is taught to visualize the fraction $\frac{3}{4}$ by the use of actual material and to think that he wants to know the value of $\frac{1}{3}$ of $\frac{3}{4}$, there is a clear process of consciousness. But if he is taught $\frac{1}{3}$ of $\frac{3}{4}$ by the process of cancellation, he obtains the answer $\frac{1}{4}$ by a vague process of consciousness. By the former method the bond formed will be strong and lasting, while by the latter method the bond will be weak and of but temporary duration. Later he may be found cancelling to get the answer to the problem $\frac{1}{3} + \frac{3}{4}$.

Connections formed between simultaneous or successive processes may vary in strength according to the degree of clearness involved. The greater the clearness the higher the level of attention and the stronger will be the bond formed. Again we may illustrate by referring to arithmetic. Mechanical devices and formulae as aids in obtaining answers usually require a lower level of attentiveness, and bonds will be lasting only according to the level of attentiveness required in learning. The bond may be made more permanent, however, by overlearning.

A third fact in learning is revealed in what is called a good or a poor learner. Good learners use clear, well-defined conscious processes and have power to concentrate. They are able to stick to a task and maintain a high level of attention. They have an unbroken succession of clear processes grouped about a single thought or idea. Poor learners do not stick to a task long enough at a time or do the work effectively. There is no continued succession of clear processes related to the same idea. Their power of concentrated attention is limited and they are easily distracted. Meaningful aspects of their experience are

not apparent to them. In any problem such as card-sorting, the good learner will discover devices for fixing the location of the different boxes, while the poor learner will not discover these time-saving devices. A twelve-year-old boy was recently assigned the task of untwisting a telephone cord. He worked at one end of the cord, then at the other, and finally gave up after thirty minutes. The differences between the good and the poor learner consist of differences in training and inheritance. In other words they are pedagogical and physiological.

The psychological facts appearing through observation and experiment have been stated. Through possible overemphasis upon native ability as related to learning, poor or good learning due to training seems not to have been adequately studied. Nor have the learning qualities of the individual due to inadequate physical condition and health habits been duly recognized. At this time it may suffice to say that both training and health are factors to be considered in learning.

The Laws of Learning. The knowledge, habits, and attitudes of an individual are the product of certain original or unlearned tendencies and his learned tendencies or training to respond to various situations. Human nature is in general the result of man's original nature, the laws of learning, and his environment. He has an enormous fund of connections or bonds between the many situations arising in relation to his environment and the responses which he is capable of making. His tendencies to respond are notably modifiable and are the real causes for the growth of learned habits. These original tendencies to respond to given situations suggest the three laws by which the organism learns — the laws of readiness, exercise, and effect.¹

Ability to Learn. While man is to the highest known degree a learning animal, he is not the only animal able to learn. Far down the scale of animal life are found creatures which perform certain acts of learning. It seems logical, then, to

¹ These laws are stated in Chap. VI as laws of habit-formation.

begin the study of the learning process in its more elemental form. Professor Jennings¹ reports the existence of a little microscopic organism called the stentor which has two or three responses to the presence of obnoxious matter in the surrounding water. One of these ciliary movements it tries first, and if without success it finally makes a withdrawal response. With the continuance of the experiment of introducing small quantities of dye into the water there appear fewer of the ciliary movements each time until finally the organism takes refuge without making any ciliary movements at all.

One should avoid attributing to the stentor any feelings or thoughts such as are possessed by human beings under similar circumstances. There may be no consciousness at all, but to the "same situation," such as presence of dye in the water, the animal "learns" to make the withdrawal response rather than other responses.

To make various responses to the same situation is fundamental in learning. From these responses the organism learns to select and make that response which produces greatest satisfaction and the least annoyance. A distinction should be made between temporary learning and permanent learning, the latter involving the formation of habits of response. With animals higher in the scale various responses to the same situation are not made in a definite order. If a hungry cat is placed in a box which it can open by certain manipulations, no one can determine with certainty just what responses it will make first, second, and so on to the situation of meat placed outside the box. The cat will make a different series of responses each successive time he is placed in the box. This type of learning is called trial and error or trial and success learning. When the animal has various responses to a situation, it tries different responses until the right one is made. Each time that the animal is confronted by the situation it makes less random responses until the right response comes to be associated with sat-

¹ Jennings, *Behavior of Lower Organisms*, pp. 174-175.

isfaction. The proper response will thereafter be made without other trials. Memory will tend to fix that right response and thereby establish a habit.

Lower animal life does not use one kind of learning and man another. Suppose an individual is given a puzzle, such as a lock which can be opened only when upside down. Never having seen a similar puzzle before, he tries in every conceivable way to open the lock, possibly without success. Finally some one suggests that he hold the lock behind him. The lock thus being inverted opens immediately. At this unexpected occurrence he studies to discover the possible reason for success. Finally he associates the inverted position of the lock with the result and, therefore, with a little practice is always able to open it. Apparently the main difference between the man and the cat lies in man's greater ability to experience and to use that experience. He learns much more rapidly. All human society employs trial and error methods. It passes unfortunate laws, then repeals them and passes other laws. It is constantly making adjustments, and, because of those errors and efforts together with more or less rational procedure, achievements in learning are made possible.

Animal Learning. Responses of the lowest forms of animal life are called tropisms. *Tropisms* are inherited forms of response in organisms devoid of a nervous system. Tropisms may be either positive or negative. A tropism is positive if the organism seeks the stimulus. Negative tropisms enable the animal to withdraw and escape from harmful stimuli. The amoeba and paramoecium are examples of low forms of animal life whose reactions are termed tropisms.

All tropisms are inherited forms of reaction. They offer the only means of activity which the lowest forms of animal life possess. There is no evidence that such forms learn by experience, although it is possible for them to make some simple adaptations to their environment.

Characteristics of Animal Learning. Typical cases of

animal learning illustrate the laws of readiness, exercise, and effect in their pure form. There exist certain situations which the animal welcomes and does nothing to avoid. Responses to such situations are *satisfiers*. Other situations are intolerable and as far as possible avoided. The animal will respond in one way after another until relieved from them. Bonds between such situations and responses are called *annoyers*. The laws of exercise and effect are likewise applicable in all learning.

Associative Learning in Man. Varieties of learning may be classified as: (1) connection-forming of the common animal type; (2) connection-forming involving ideas; (3) learning by analysis or abstraction; and (4) learning by selective thinking or reasoning.

The common animal type of learning is accidental. Improvement in procedure and short cuts are stumbled upon irrespective of ideas, as the ten-months-old baby learns to beat a drum. The second variety of learning follows the same simple associative plan except that ideas are in associated series. This variety of learning produces the major part of our knowledge. As a higher type, man learns to isolate and respond to elements of the situation. He selects elements out of a gross situation, and analyzes them for individual response. Learning by selective thinking and reasoning, the highest type of all, will be given prominence later.

Our daily life is made up of experiences. We learn to respond to these indirect factors of our environment and thus avoid the need for constant thought and anxiety over each detail. The direct reason for an act precipitates the act; and also in like manner each incidental factor in the environment at the time of the act assumes a certain ability to provoke the same response. This we call associative learning.

Real Learning. Man inherits a mechanism for unconditioned reflex activity and vast potentiality for acquiring conditioned reflexes¹ on account of his neural mechanism. This

¹ For an explanation of conditioned reflexes see Chap. VI.

potentiality provides the capacity for learning. Real learning consists largely in acquiring conditioned reflexes. The child probably walks and performs other activities without real learning, as soon as the required neural mechanism is sufficiently developed; but talking and reading seem to illustrate real learning.

There are, unquestionably, inherited mechanisms for making articulate sounds, "but learning to speak a particular language is a case of the acquisition of a vast number of conditioned reflexes."¹

Kinds of Learning. Burnham² mentions three kinds of learning. The first kind is the acquisition of those reactions for which the neural mechanism is congenital and inherited, such as learning to walk and the normal reaction of the fundamental organs. These reactions really do not involve learning at all. The individual inherits these ready made and partly developed at birth. They become fully developed with normal growth. In case of lower animals such reactions are actually made almost immediately. The calf can stand up, and walk to some extent even the first day after birth. The duckling when very small will swim as soon as it can reach the water.

The second kind of learning consists in acquiring temporary associations, the temporary conditioned reflexes. The great part of our learning is of this kind and useful only for a short time. The associations, soon broken down, make way for others.

The third kind of learning consists of acquiring permanent associations. Such associations may be acquired in two ways: (1) by many repetitions; and (2) by a single intense initial reaction. The acquisition of permanent associations is perhaps the most important of all learning.

The significant difference between the second and third kinds of learning lies in the permanency of associations. The reason

¹ Burnham, *The Normal Mind*, p. 146.

² *Ibid.*, pp. 146-148.

for more temporary than permanent associations being formed has not been adequately explained. This fact, however, does make possible a greater capacity for habit formation,¹ and the provision for one's adaptation to his environment. The human being naturally lives over a period long enough for him to experience enormous changes in the material and social world. To these changes he must adapt himself in order to survive. Fundamentally, then, the second kind of learning is most essential; but in the light of social progress, if humans are to benefit by past experience, the third kind of learning is more important. The fact that the odor of a flower, the sight of a turkey, or the incoming waves of the ocean bring back to memory some early scenes of childhood is of more than passing value.

All Learning Is Analytic. The bond formed between situation and response never leads absolutely from the entire situation at the moment. Each such bond is composed of minor bonds between the parts of the situation and parts of the response, each having a degree of independence. With individuals of at least normal mentality, modern life-training results in the formation of an enormous number of bonds with separate elements to situations. Their intellectual life seems to consist as much in discriminating and abstracting as in associating.

All of man's learning and indeed all his behavior is selective. Between a situation S and a response R there is an association or connection. This association is a trait of all learning and without it no learning is possible. In a response "pretty" to a picture the R is not made to the S in its entirety. It is made to an element in the entire situation. There is association, analysis, and selection, or what Thorndike calls partial or piecemeal activity. The cat "placed in a box with food outside" responds to that situation rather than the S plus other surrounding elements. Some elements produce certain R's more surely than others.

¹See the "Origin of Habits," Chap. VI.

A situation often provokes responses not bound to it by original tendencies, use, or satisfaction. Responses to novel situations, in association by similarity and the like are due to habits, particularly those of responses to certain elements or features. One might think of the moon when seeing a cow, or of the old barn on the homestead where he was born. Not that there is any similarity between these objects, but his learning of a nursery rhyme "and the cow jumped over the moon" together with his habits of thinking cause certain associations to be made. Such early associations are most helpful in individual learning.

Attitude in Learning.¹ Very little work is undertaken in school or elsewhere except as there is a *desire* for doing it. Children often remain at home for a day or more by preference, having been able to convince themselves that it is to their advantage to do so. Their rationalization has aimed to satisfy desire. People are often heard to give reasons for certain of their responses, which are not real reasons at all. It is true that some work is done, such as studying an assignment in geography which the child does not desire to do; but he desires to do this work in order to avoid something worse.

In our criticisms of associates, some desire lies behind our assertions. If more satisfaction than annoyance is derived from favorable criticism, our criticism will be favorable and vice versa. In other words we respond as we desire. Recently an eighth-grade group working under a departmental school organization were given a choice of studying either activities in health or problems in arithmetic. They chose health. It is evident that members of the class consider health of greater vital concern to them than arithmetic.

Desire for study is largely a matter of curricular humanization. The term curriculum as here used comprises all the educative situations set up by the school. These situations are usually classified under four heads: (1) course of study; (2)

¹ Myers, *The Learner and His Attitude*, Chap. I.

method; (3) school and class organization and management; and (4) measurement. Much interest and desire for study is lacking naturally because situations set up are neither vitalized nor humanized. History, for instance, is made about as unattractive as possible because of the fact that there is so little about it that the child finds a need for knowing or considers that it has any special human relationship. In order to vitalize situations in subject matter the material should appeal to the student as having utility; and it should be humanized by giving the textbook material a real human origin.

Learning Morale.¹ One's feelings at the time condition his success in learning and even his efforts to achieve. Pleasant or unpleasant feelings attending an experience affect one's feelings toward a subsequent experience. Failure in a subject tends to cause a pupil to do poorer work as a repeater. Nothing makes for success like success.

The learning morale of a class is clearly the communicated morale of individuals of the group. The teacher's morale affects the pupil morale, and the pupil's morale conditions the learning possibilities of other members. Teachers, then, must be boosters, and sell their orders rather than command them. A learner's morale may be substantially destroyed by censure rather than encouragement,² by adverse criticism instead of constructive suggestion, and by minimizing his ability to succeed. Pupils grouped according to so-called intelligence scores tend to live up to their reputation if that trait is emphasized by the teacher or by members of the group to the extent that an inferiority complex is established. Why hang a crepe around a child's neck? His errors and failure may be due to bad habits in learning, ill health, or inadequate care at home rather than inability or maliciousness. With proper assurance and material, most learners can excel beyond expectation. Even poor

¹ *Ibid.*, Chap. IV.

² Gilchrist, E. P., "Superiority of Praise over Reproof in Learning." *School and Society*, pp. 872-874, December, 1916.

groups, in the experience of the writer, are able to do better school work than the average attainment of better groups. The learning tasks should be definite. Assignments are generally too abstract, and many of them are not socially worthy of pupil response. A teacher recently required her class to memorize in order of size the ten largest cities in the United States, and the textbook information used by the class was based on the census of 1910. Another teacher spent two weeks teaching the structure of the neurones to an elementary class of less than average ability.

Rewards and Punishments as Related to Learning.¹

Rewards are as natural as punishments; both are normal; both are necessary to behavior adjustment; and both are hedged about by serious dangers. Rewards usually are accompanied with pleasurable feeling. Punishments are rewards intended to produce annoyance. All effort is put forth to avoid penalty and to secure reward, either direct or indirect, present or future. Punishment, or what may be called annoying rewards, are not so often justified in the improvement of behavior, ideals, and attitudes. There is serious danger of their producing the opposite effect.

Prizes as rewards are valuable in learning if they have some other than a momentary meaning. They should emphasize group and not individual goals. Coöperative habits and socialized ideals are most fruitful in promoting happy attitudes; and such attitudes promote learning. Thorndike ² says: "But certainly, if the direct present happiness of children does not conflict with the ultimate ends of education, it is wholly desirable, and even if it does conflict somewhat, it has a right to be put in the balance against future goods, and chosen if it outweighs them . . . And it would be a brutal consequence of adult control of education if we failed to give children their kind of happi-

¹ Smith, *Constructive School Discipline*, Chaps. VIII-IX, and Myers, *The Learner and His Attitude*, Chap. V.

² Thorndike, *Education*, pp. 19-20.

ness merely because, as adults, we did not ourselves when old value it as highly as their happiness. Yet, just this folly and this brutal inability to appreciate values which we do not ourselves enjoy, have in the past had vast influence in deciding the character of school work, and even now are at work in many homes and classrooms."

School marks,¹ a form of reward to encourage effort in learning, have had a long and tragic existence. Until very recently they have largely been subjective. Every effort to render a subjective school mark meaningful has failed. From the many studies that have been made in this field it is evident to the writer that only on the basis of objective measures should school marks be derived.²

Health and Learning. There is no more potent hindrance to learning than ill health and its essential cause — bad individual health practices. Teachers ordinarily do not know the physical condition and health habits of the children they teach and scarcely realize the extent to which health conditions learning. Naturally, after so much emphasis upon psychology and the testing movement, they assume that differences in ability to learn are largely native. This may or may not be true, and such a conclusion is unwarranted until both mental and physical health are known.

Many of the undesirable habits affecting health are due to ignorance, especially in the home. Children often come to school with either no breakfast at all or having had only coffee and a bun. Such pupils are inadequately nourished. Often they are not clean. They may have had too little rest, or exercise in the open air, or both. Even if properly fed they may be suffering from malnutrition. Their teeth may be decayed to the extent that health is quite impossible. Through fear of a dentist or physician, children often do not reveal their true condition. The school should discover and strive to have physi-

¹ See Chap. XVII.

² For further study see Myers, *The Learner and His Attitude*, pp. 98-100.

cal defects corrected. By no means of less importance is the need for keeping well children at their best. Otherwise children cannot learn up to their full capacity.

Much depends upon the mental health of the learner. Calmness rather than excitement should prevail in the classroom. Well fed children, even when free from physical defects, often fail to gain in weight. With children, failure to gain is an indication of either physical or mental ill health. Fatigue through excitement, distractions, and worry are conducive to mental dissipation.

Education and Learning. Education may be regarded as the process going on in the individual whereby changes in behavior are produced. These behavior changes may result from consciously organized propaganda, from social pressure, or other organized agencies. It may be conceived as a lifelong process, and the result of the learning process. But it is not equivalent to learning. A person may learn in many ways and his behavior may be changed as a result of what he has learned, whether the changes take place in a desirable or undesirable direction.¹

The educational process is generally conceived to be a valuable process for the individual and for society. Without question there is much learning that has no social value, and that cannot be considered a part of education. It may not have any bearing upon behavior either favorably or unfavorably. As an illustration we are reminded of requiring pupils to memorize variable facts, of learning subject matter that can be of no use to the learner, memorizing nonsense material for punishment, memorizing corridor and school rules, and the teaching of formal grammar for which no need has arisen.

Economy in Learning. Learning seems superior when the student understands the problem at hand and has definite knowledge of what is to be done and learned. The aims should be few enough for real accomplishment. Too many aims de-

¹ Payne, E. George, "Education and Social Control." *Journal of Educational Sociology*, Vol. I, pp. 137-145, November, 1927.

feat their own end in that there is insufficient practice in any given activity and too little thoroughness.

Problem of Attention. Closely related to definiteness of aim, both attention and interest should be considered as means. Habits of sustained attention are also among the most important results to be attained. Foremost conditions of improvement lie in ability to attend, to select correct responses, and to practice them. As learning proceeds and habits take over activities, attention should be directed to other aspects of the problem and gradually to the general aim or total performance. But attention should not be directed to our sensations and feelings. This leads to poorer performance. Likewise attention to fully habituated acts is likely to hinder rather than aid performance.

Practice and Repetition. Wrong responses should always be eliminated. Otherwise, practice makes them habits just as it makes habits of right responses. There are two fundamental factors in all learning. First of these factors is correct practice. The old adage states that practice makes perfect, but perfection may be either right or wrong according to what is practiced. We have been told also, "learn to do by doing." Instead, we should say, learn to do by doing correctly. We do not learn to speak correctly by speaking. We must speak correctly.

The second fundamental factor is repetition. This should be made under most favorable conditions. Experimentally, thought repetition seems superior to mechanical repetition. Only correct repetition should be permitted. Allow no errors, and eliminate all irrelevant features.

Speed and Accuracy. Contrary to some traditional notions, the greatest accuracy accompanies greatest speed. Speed, however, should never be sought ahead of accuracy. Work first for accuracy, then force the speed. Avoid developing the habit of acting slowly. Efficiency in mental functions requires that such habits be broken later. Improvement in both speed and accuracy is possible for practically everyone. A higher

quality of work can be done as easily as a lower and with greater satisfaction.

Learning and the Learner. Economy in learning depends largely upon the attitudes and the activity of the learner. He must intend to learn, and be determined to learn. He must learn for a purpose, intend to remember, and will to succeed. The task should not be too difficult nor too easy for the learner. He should undertake only tasks worth undertaking, and should begin as he would achieve. Practice exercises should be composed of the same significant material and provide practice identical with regular exercises. In written work one should practice what is to be written, and the way it is to be written.

Most of the learning being conscious, it is important that the learner's attitude be determined and favorable to the highest achievement. The most important learning is that involving thought. Much of the so-called learning is not real until actually understood. Properly rationalized methods of study lead to more effective and economic results. That learning is most effective under proper physical and environmental conditions should not be minimized.

Amount, Rate, and Limit of Improvement. So far as has been discovered, no mental function has ever been deliberately practiced for the purpose of improving it without some improvement as a result. All functions in which one takes a real interest are improvable unless practices have already put them at their limit, and such cases are very rare.

Improvability has been found impossible in weight discrimination, pitch discrimination, and the like; but failure to discover improvement was due to one of the following causes: (1) failure to inform the subjects whether they were right or wrong and the direction and amount of their errors; (2) failure to give the subjects an adequate motive for improvement; and (3) failure to give practice of sufficient scope so that the limit is not reached too early.¹

¹ Thorndike, *Educational Psychology*, Vol. II, pp. 151-152.

Differences in Improvement. One should not interpret a change in the score obtained in measuring a mental function as the measure of change in efficiency. An early score may be 25 and a later score 50. These figures in themselves have no real significance except as other conditions are known. Near the beginning of practice, improvement is ordinarily rapid; but as one approaches maximum efficiency, indicated improvement is very slow. At this point a changed score of 5 may have greater value than 25 near the beginning. Not only the numerical indications of amounts, and the slope of the practice curve, but also the actual behavior facts denoted by the score must be considered in every case.

Differences in improvement may be considered under four heads: (1) differences in methods of work; (2) differences in previous training; (3) differences in original nature; and (4) differences in physical fitness. It is of the utmost importance in educational practice that observed differences in improvement be evaluated in terms of their specific causes along these four lines. While differences in original nature may be responsible for much of the variation found, one must be certain that it is actually original nature rather than physical incapacity, or differences in previous training along lines that may handicap the subject in the particular function.

In measuring differences in improvement it must be remembered that the gain of units is much more difficult for the individual who begins with a higher initial efficiency. For more accurate measurement each subject should start with zero efficiency in the particular function.

It is generally conceded that a majority of adults remain far below their limit of efficiency even when it is decidedly to their interest to improve. At the same time they may convince themselves that they are doing their best. Probably the majority of teachers do not improve after their third year of service, and it is certain that they could teach much better than they do. It is conceivable that their failure to approach more nearly

their maximal limit may be due largely to improper attitudes, lack of initiative, bad mental habits, and the like resulting from unfortunate training. Those who do really excel have many unfortunate mental habits to overcome before such improvement is possible. Many more right connections can be formed than are usually formed; and much greater fluency of action is possible if conditions of adequate stimulation and reward by satisfaction are provided.

The law of diminishing returns should be more carefully studied in relation to the learning process. Expertness is not always valuable to all. Thorndike ¹ reminds us that "there is no great value in getting horses to trot in two-thirty or faster, since we can more conveniently go at these speeds in automobiles; nor in getting a man able to choke a tiger with his naked hands, since it is tidier to shoot it." We have whittling, penmanship, typewriting, painting, music, and sewing which may require any given person to practice beyond the point of diminishing returns. Some pupils practice certain functions too long, and at the same time we undervalue certain high efficiencies.

FACTORS AND CONDITIONS OF IMPROVEMENT

Elements of Improvement. The rise of a practice curve parallels the growth or change in attitudes, habits, and interests. This change means that certain satisfying bonds are strengthened and annoying bonds are weakened. The balance between satisfyingness and annoyingness has changed.

External Conditions of Improvement. Conditions of improvement may be classified under four heads: (1) external conditions such as distribution of practice periods, time of day, and adequacy of equipment and surroundings; (2) physiological conditions, such as dosing with stimulants like coffee and tea, malnutrition, anaemia, lack of rest, or an attack by certain

¹ Thorndike, *Educational Psychology*, Vol. II, p. 185.

diseases; (3) psychological conditions, such as interest, worry, fear of failure; and (4) educational conditions, such as the organization of practice drills, and the attitudes, habits, and methods of work. We shall consider mainly among the external conditions the distribution of practice.

While the distribution of practice periods may differ for younger and older students, research studies in this field agree that several short periods are better than fewer longer periods, for memory work. Four conditions are involved in the distribution of practice: (1) concentration versus distribution; (2) optimum length of periods of practice; (3) optimum length of intervals of rest; and (4) reduction of the length of practice periods.¹ The first of these is illustrated by the study of a poem for 60 minutes one day as contrasted with the study of the same poem 20 minutes a day for three days, or 15 minutes a day for four days, or 12 minutes a day for five days, or 5 minutes a day for twelve days. In all cases the amount of practice is the same, but under which plan can most be accomplished? Ebbinghaus² found that in memorizing nonsense syllables the greater efficiency was obtained by distribution of practice over three days rather than by doing all in one day. Jost³ and others have verified these conclusions. Starch⁴ found both the 20 minutes once and the 10 minutes twice a day distributions markedly superior to 40 minutes every day or 120 minutes all in one day. A long period of sustained work may be essential for solving problems or for writing. Continued practice definitely organized seems superior to spasmodic efforts at odd times. The reason for such a conclusion may be found in the lessened interest of the learner due to fatigue in the case of long periods of study, and the reduction of the probability of fatigue and increase of interest in the case of shorter periods.

Experimental results as studied and summarized by Thorn-

¹ Mead, *Learning and Teaching*, Chap. VI.

² Ebbinghaus, *Memory*, p. 122.

³ Reported by Thorndike, *Educational Psychology*, Vol. II, p. 195.

⁴ *Ibid.*, pp. 199-202.

dike¹ justify roughly the avoidance of very long practice periods and of very short intervals of rest. The length of period depends on the amount of variety and satisfyingness involved. Periods of learning should not be in terms of hours, but rather 10, 15, 20, or 30 minute duration. With reference to the interval of rest probably the safest generalization that can be made is that the interval between periods of practice should be in terms of hours, the maximum interval being one day.

Cummins² has investigated the fourth problem, that of the reduction in the length of practice periods, and has verified the possibility of reducing the length of such periods after the completion of initial periods of practice. Such reduction may safely consist of either a reduction of the length of the practice periods itself or of the number of practice periods. A schedule of distribution might be either of the following:

	First Day min.	Second Day min.	Third Day min.	Fourth Day min.	Fifth Day min.	Sixth Day min.	Seventh Day min.	Eighth Day min.
(1)	20	20	20	15	15	10	10	10
(2)	20	20	20	0	20	20	0	20

He concludes that:

1. Distributed practice, other conditions being the same, will be more economical than concentrated practice.
2. Periods of practice should consist of parts of hours.
3. The intervals of rest should be in terms of hours.
4. After initial periods of practice, the practice may be reduced as indicated above.

At least five factors in our schools should be influenced by these conclusions as to the distribution of practice: (1) The course of study should provide for an adequate distribution of reviews of content to be mastered. (2) The textbook should

¹ *Ibid.*, pp. 196-206.

² Cummins, *Improvement in the Distribution of Practice*.

include systematic reviews of content to be learned. Some texts have already conformed to this requirement. (3) The teacher's organization of content and methods. (4) The learner's habits of study. (5) The factor of interest.

Dewey's definition of interest: "To be interested is to be absorbed in, wrapped up in, carried away by, some object. To take an interest is to be on the alert, to care about, to be attentive. We say of an interested person both that he has lost himself in some affair and that he has found himself in it. Both terms express the engrossment of the self in an object."¹

How can we cause pupils to become interested? (1) Many children and most adults prefer to sleep peacefully in the midst of problems rather than attack them. Others enjoy multi-form activity and are easily led to take an active, inquiring attitude. This leads to an inquiry as to the cause of indifference. (2) Adjustment and selection of subject matter, methods, and activities will cause the learner to recognize that activity is relevant to his needs.² (3) Motivate, vitalize, and humanize school life.

Methods of Memorizing and Acquiring Skill. The need for understanding in memorizing is shown by attempting to commit to memory a long selection of nonsense syllables. Pupils should be encouraged to remember by rationalization, and discouraged from memory by tricks or sheer repetition. In the use of a formula or other mental apparatus students should not necessarily be required to possess full understanding before it is used. Use contributes to understanding if there is a conscious effort in that direction. Problems, however, should be solved from first principles rather than rules.

Experiments of Stuart and Oakley³ show that the development of an understanding of a time sense is not to be expected earlier than age eleven. Before that age it is sheer memory.

¹ Dewey, *Democracy and Education*, p. 148.

² Dewey, *Interest and Effort in Education*.

³ Thomson, *Instinct, Intelligence, and Character*, Chap. XXIV.

Part or Whole Method. Experimental work on memorizing best known is probably that which contrasts the "whole" with the "part" method. By the "whole" method is meant memorizing a poem or other selection as a whole rather than by parts. The "part" method implies memorizing in parts. A survey of the psychological literature shows that most writers favor the whole method of learning. Among these are Meumann, Gates, Colvin, Freeman, Pillsbury, Starch, Hunter, Woodworth, and others. Meumann, however, discovered facts in his own laboratory favoring the part method for economy in learning time. Ephrussi found the part method better for vocabularies and nonsense material. More recent experiments by Pyle, Lakenan, and Snyder favor the whole method, while those of Reed and Pechstein favor the part method. So far results have been too largely with adult learning and have been obtained from too few individuals for reliable conclusions.¹

Students finding the part method superior have probably formed the part-method habit. Prejudice against any particular method may give poorer results at first. While many claim for the whole method a better grasp and more permanent retention, the modified part method or the modified whole method is likely to prove superior. There is reason to consider individual differences particularly when there is a wide difference in age. The problem thus becomes complicated by age factors. The whole method may be too difficult or the material too lengthy for younger children.

With children the part method is preferable. They can thus know at what rate they are progressing and gain confidence. The teacher can test a pupil and find out what has been accomplished. By the whole method the pupil is likely to lose heart. He cannot believe that shortly the entire selection will rise above the threshold of his memory.

Bad and Good Memories. The attitude that one has about memory is unfortunate. There probably are differences in

¹ Skinner, Gast, and Skinner, *Readings in Educational Psychology*, pp. 505 ff.

memory just as there are other differences, but these differences in mental achievement are largely due to variation in habits of learning and attention. Mental retention depends far more on interest and frequency of recall than upon inheritance. Powerful instincts such as pride, possession, competition, and the like cause the interest. New and novel situations arouse curiosity and wonder, and the most vital factor is curiosity.¹

Teaching is Stimulation. For efficient learning, stimulation is an absolute essential. It has two functions: (1) to arouse the desired activity, and (2) to help direct that activity. Chief functions of the teacher are to teach how to study and to supervise study. Too often we see assignments made and the children left unguided while the teacher talks to some other teacher or does clerical work. The teacher's procedure should be governed by the laws of learning. These laws must be applied.

Education is not just the teaching of subject matter. It involves adjustment and adaptation. This adjustment is both individual and collective. "There is a collective learning process as well as an individual learning process."² Learning takes place in a social situation. Begin as early as possible in having pupils perform activities that are useful now and will be useful later, *and only those*. Real transfer of training is made more probable by the changed viewpoint that the primary purpose of learning is to bring about changes in social behavior.

Overlearning. A large part of the learning required in traditional so-called education was for the moment, just barely to recite tomorrow, or to pass an examination. The practical view seems to insist that learning worth while is for more permanent retention. To learn something so that it can be repeated or used a month from today or a year hence requires many more repetitions. "The over-exercise beyond what is needed to form a bond is in actual practice, up to a certain limit,

¹ Dewey, *How We Think*, Chap. III, p. 306.

² Ellwood, C. A., "What is Educational Sociology?" *Journal of Educational Sociology*, Vol. I, p. 27, September, 1927.

the very exercise which relearns it (or keeps it from needing to be relearned).”¹ As they combine in actual practice, the general effect of relearning and overlearning is the same. Overlearning is far more economical, and accounts for part of the less effect of disuse.

Learning Involves Work. The teacher should not interfere with the learning of the student. Stenographic reports show that teachers do as much as 75 per cent of the work of the lesson. Learning is the process that goes on when the learner does the work. Carrying a child is not teaching him to find his own way.

Learning Curves.² The progress made in learning or in forgetting is often portrayed graphically by the use of a curve showing the increase in efficiency due to practice, or the decrease in efficiency due to lack of practice. The type of a learning curve in which attention is given to the development of skills is quite different from that in which reflective thinking is involved.

In sensorimotor learning, progress may be slow for some time. After considerable practice the learner begins to make proper adjustments to stimuli, and the increments due to practice become greater with each successive practice period until a high degree of skill is reached. A puzzle often challenges the learner for a long period without apparent result. After the learner hits upon the correct manipulation, the responses may be perfected in a few trials.

There is no typical learning curve. The ideal curve is one showing rapid progress for a time; then successive practice periods show decreasing increments until the limit of improvement is reached. Most learning curves show a rapid initial spurt with a later falling off in rate of progress. This form of the curve may be due to : (1) the element of novelty of a new task, which soon wears off; (2) previous knowledge of or skill in the involved activity; and (3) the fact that in the early stages

¹ Thorndike, *Educational Psychology*, Vol. II, p. 279.

² See also Chap. XVI.

of practice, apparent rapid progress is more easily attained. The learner may not start with zero learning, because previous acquaintance with some of the elementary movements required in the initial stages may have been partially mastered through practice in similar functions.

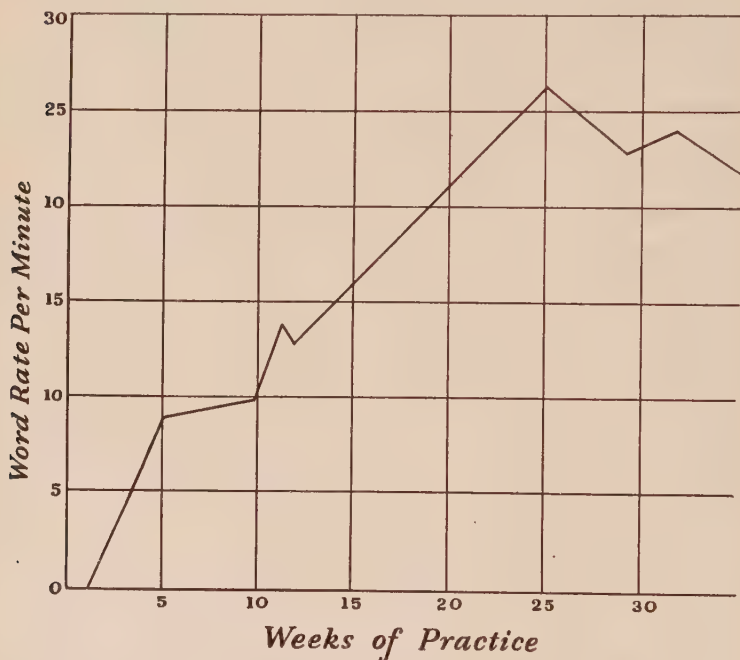
No learning curves are perfectly smooth. They show irregular progress through successive practice periods. These irregularities may be due to: (1) chance elements which are operative in a particular trial; (2) the presence or absence of distractions; (3) physical conditions of the learner such as fatigue or illness; (4) interest in progress; (5) concentration; (6) determination; (7) whether quality or speed is being emphasized; and (8) the nature of the tests devised to measure progress in learning.

The learner is making progress along several different lines at the same time. He is having to form many different bonds each of which is an element of the general problem. Let us assume, for example: (1) that the total improvement in a function from the lowest to the maximum efficiency is due to a given number of bonds to be formed; (2) that each of these bonds is equally easy to form, requiring the same time at the individual's maximum power; and (3) that each of them has an equal effect in raising the score; (4) that (2) and (3) hold regardless of the order in which the bonds are formed; (5) that only one bond is being formed at a time; (6) that no effect on the score results from the formation of a bond until it is completely formed; (7) that the work is always done at the learner's maximum power; and (8) that this maximum power is constant throughout. The curve of practice will then be a pure staircase, with equal steps, each with height 1, and with as many steps as there were bonds. If each equal fraction of time is spent at the learner's maximum power upon any bond formed, then, other conditions remaining the same, the curve would be a straight line until the limit is reached.¹

The learning curve at different points may show either posi-

¹ Thorndike, *Educational Psychology*, Vol. II, pp. 263-264.

tive zero, or negative acceleration. Positive acceleration means that more and more appears to have been accomplished in each succeeding practice period. A curve is said to show zero acceleration when no improvement is evident, and negative acceleration when the learner seems to accomplish less and less with succeeding practice periods.



CURVE SHOWING PROGRESS MADE IN LEARNING TO RECEIVE
CONTINENTAL CODE

The figure shown above is a learning curve which shows the influence of practice in learning to receive Continental code, and the effect of thirty-one weeks of practice, eleven of which were spent by the subject at The Great Lakes Naval Training Station and the remaining twenty weeks at the U. S. Naval Radio School at Cambridge, Massachusetts.

Three hours a day on the average of four days per week were given to receiving at Great Lakes and three hours a day for five days per week were devoted to receiving at the U. S. Naval Radio School. Speed tests were given weekly in receiving. After the first week of practice the learning curve shows rapid progress until a rate of nine words per minute is reached as the result of five weeks of practice. After five weeks of additional practice only ten words could be received per minute. A gain of four words per minute was made during the eleventh week. The curve shows a loss of one word per minute at the end of the twelfth week. This loss was perhaps due to the effect of a seven-day furlough just previous to being transferred to the U. S. Naval Radio School. Fairly steady progress was made from the twelfth week until the twenty-fifth week, at which time twenty-seven words could be received per minute. The twenty-eighth week shows a drop of four words per minute. This loss was due to the excitement and "let up" owing to the signing of the Armistice. After the Armistice, the subject lost interest in radio and wished to return to civil life. It was impossible to receive twenty-seven words per minute after the Armistice had been signed.

Two positions on the learning curve are significant. The first appears at the end of the fifth week when nine words were being received per minute. The influence of five weeks of practice increased the efficiency in receiving by only one word per minute. A place of this kind on a learning curve where little or no apparent progress is being made is called a *plateau*. Some psychologists regard plateaus as "artifacts" which are produced artificially by crude methods of measurement. Plateaus are characteristic of most human learning. They seldom, if ever, appear in animal learning.

A plateau in the learning curve is undoubtedly caused either by a lack of interest and effort, after the novelty wears off, or to improper methods of learning. In learning Continental code the plateau was undoubtedly due to wrong methods in learning,

as the best efforts of the subject were given until the Armistice had been signed. Until nine words per minute were achieved, the subject had ample time to analyze each separate group of dots and dashes and to record the letters for which they stood. Before further progress could be made, each group of dots and dashes had to be recognized as a unit. It is unlikely that a plateau would have appeared had each group of dots and dashes been heard and interpreted as a unit from the beginning.

The other characteristic of the learning curve which is worthy of consideration, is the one which shows the greatest efficiency in receiving. For three successive weeks a speed of twenty-seven words per minute was reached. This speed may have been near the physiological limit of the subject, unless better details of method had been found and perfected.

Bryan and Harter¹ made a classic study of the acquisition of skill in learning to receive in the telegraphic code. They were the first experimenters to recognize the plateau.

Forgetting in the learning process helps the student to lose unnecessary or irrelevant details. It is not necessary to remember the totality of each situation; otherwise it would be impossible to strip situations down to essentials or to discover common principles in a series of situations. Education can render no greater service than to give the learner power to abstract the ideas in common from the masses of material he meets.

The learning of material becomes more complete when the idea is applied or used. Any process that is to be used should be learned as nearly as possible through the same senses and in the same situations as those to which it is to be applied. Learning thus makes possible the minimum of real adjustment in its practical application.

Forgetting is essentially the result of underlearning, or the result of a weak bond between situation and response. Disuse is a disease which deteriorates the bond and gradually breaks

¹Bryan, W. L., and Harter, N., "Studies in the Telegraphic Language." *Psychological Review*, Vol. VI, 1899.

the connection. One is reminded that disuse has little effect upon the deterioration of skills. When a person has learned to swim, skate, or ride a bicycle he possesses that ability for life. His skill may be temporarily dulled after he has not been skating for ten years, but he has not really lost the art. This may be accounted for by the fact that the neurone connections involved belong to lower levels nearer that of the instinct and reflex rather than to the higher levels involved in purely mental processes. The greater permanence of skill may be due in part to overlearning. Then again, a skill may require for its very existence that earlier and simpler movements be repeated and thereby be made more certain. One, for instance, cannot become skillful at driving an automobile without causing the simple movements of starting and of using clutch, brake, and gear-shift to become practically automatic. In this way one gets a tremendous amount of practice beyond immediate needs, thus causing persistence over periods of neglect.

Psychological and Economical Principles of Learning.

1. Rote memory is justified only to the extent to which it is later connected to meaningful situations.

2. Crutches are temporary devices to help students over difficulties. The student has to learn both the device and the information. If the device is forgotten it will be impossible to recall the material for which it stands. Crutches may be justified sometimes in learning long lists of disconnected material.

3. Habits should not be formed which may later be detrimental to progress. Children should not be permitted to count on their fingers because the habit thus formed must be broken if proficiency in adding is to be attained.

4. Undesirable responses should be eliminated or modified before they reach the level of habit, by attaching annoyances to them. Desirable responses should be encouraged by associating them with satisfaction.

5. In teaching subject matter it is always best to present the correct model. The presentation of incorrect forms in English,

spelling, or writing is undesirable because the incorrect forms may never have been encountered. The teacher should be on the alert to detect errors before they become habituated. Incorrect reactions should not be mentioned after their discontinuance.

6. One avenue of sense presentation is about as good as another in the case of adults. With children as many of the senses should be utilized as possible. In teaching numbers the children should feel, see, hear, manipulate, and write. Learning through motor activity is very economical.

7. Learn to do a thing in the way it is to function in actual life. One learns exactly what one practices. The way to learn to write, play ball, or any other activity is by actually doing the thing.

8. There is no satisfyingness like success and the desire for success. Constant failure soon produces a distaste for work. Meek¹ investigated the importance of success in the first lessons of children from three to five years of age. The children who met with some measure of success took up the work of the next day with eagerness and satisfaction. The children who met with a few successive failures became reluctant to recite. Some of those who failed became disturbed emotionally and sought to avoid the task.

9. Children should be encouraged to work rapidly. It was once believed that the rapid reader or learner was the rapid forgetter. This is by no means the case. Experimental results have shown that the rapid reader and learner retains better on the whole than the individual who reads and learns more slowly.

10. Few pupils, if any, reach their possible limits of improvement. Most people do less than they can. Determination and correct practice are necessary if one is to attain his maximum of efficiency.

¹ Meek, *A Study of Learning and Retention with Young Children*.

11. A knowledge of progress and of the errors made helps to facilitate the learning.

Arps¹ found that a group of students who had a knowledge of their achievements did eighteen per cent better than the group of students who had no knowledge of their achievements.

Interest, purpose, and a knowledge of the results of the efforts of the students make for better school records. If the students have something definite to attain and are fully aware of the aims of the lesson, attention and effort are less likely to be misdirected.

12. After studying one type of subject matter, pause before taking up some other activity. The last impressions made while learning one type of material are likely to interfere with the new impressions first formed while studying another type, unless the former impressions have had time to become fixed.

13. Intention to recall facilitates learning.

14. Much effort in learning is wasted because it is not directed toward specific ends.

15. The adult learner does much better under definite incentives than when he has no particular motivation.² If a subject is directed to work as hard and as long as he can with a certain piece of apparatus he will not accomplish as much as if he had been assigned some specific task.

16. When a plateau appears, everything should be done to make the plateau of as short duration as possible. First, diagnose the cause of the plateau and apply proper remedial measures. Correct methods of practice and interest will aid in overcoming a plateau.

17. The best results in learning take place under strong incentives. Some trainers of animals use the whip as an incentive; others offer food as a reward. If animals were not given rewards or punishment they would never practice certain ac-

¹ Arps, "Work with Knowledge vs. Work without Knowledge of Results, *Psychological Monographs*, Vol. XXVIII, No. 125, p. 41, 1920.

² Wright, W. R., "Some Effects of Incentives on Work and Fatigue." *Psychological Review*, Vol. XIII, pp. 23-24, January, 1906.

complishments. A feeling of need for knowledges and motor skills is a strong incentive and facilitates learning.

18. When ideas have been learned in one connection, it is difficult to learn them in another connection. It is therefore important that they be first learned correctly.

19. Rhythm can often be employed to advantage in learning disconnected sense material.

20. Experimental results generally show the whole or the mixed method of learning (memorization) to be superior to the part method, because the connections are formed in the order in which they are to be used later and a knowledge of what is to come makes recall easier.

The usual procedure for learning a long poem or piece of prose is to employ the mixed method as follows: (1) to read the entire selection from beginning to end a few times to get the thought of the whole; (2) then divide up the selection into convenient parts and learn the parts separately; and finally (3) go over the entire selection until the connections are firmly established between the parts.

21. In both human and animal learning there is an optimum number and frequency of trials in building up bonds as economically as possible. One trial every two days has been found to be the most economical arrangement for establishing motor habits in animals. A large number of trials a day has been found to be very uneconomical.

In the case of human learning where motor coördination and skill is involved, trials at daily or longer intervals are usually more economical than concentrated periods of practice. Murphy made an investigation to determine the most economical distribution of practice periods in learning to throw the javelin and concludes that "learning periods can be distributed by giving alternate days practice, and even weekly practice without any loss in learning."¹ Distributed practice periods have been

¹ Murphy, H. H., "Distribution of Practice Periods in Learning." *Journal of Educational Psychology*, Vol. VII, p. 150-162, March, 1916.

found to be more economical in memorizing both prose and poetry, than concentrated periods.

22. Apperception is a term used to denote that objects are perceived in the light of past experiences and the present state or condition of mind. It is important for the teacher to remember that the only way possible for children to get the significance of a new principle or fact is to interpret it in the light of the past experiences of the children. It is imperative that the teacher become actually acquainted with the various experiences of the children rather than assume that her experiences are theirs, or that they have all had the same experiences.

FATIGUE

Effect of Fatigue on Work. Continuous exercise produces a temporary inefficiency of mental functions. This decrease in the capacity to do work is called *fatigue*. The definition of fatigue is open to criticism because continuous work does not always seem to be followed by a reduction in capacity for doing that kind of work. Some maintain that there is no mental fatigue, but that the individual merely loses interest in his work, although the central nervous system does not lose capacity for work. Undoubtedly continuous work does produce a lessened capacity although the inefficiency produced may be compensated for by extra effort and by the effects of practice. The awareness of fatigue may spur individuals to increased effort. It is possible that adrenal secretion lessens fatigue by stimulating the liver to an increased secretion of glycogen (blood sugar).

Physiological Nature of Fatigue. Some of the first studies of fatigue were made on frogs. The stimulation of motor nerves in a frog causes muscular contraction. If the stimulations are continued, the contractions become less and less until they finally cease altogether. Fatigue in this case is caused by a breaking down of the connections between the nerve and

muscle. This appears to be the case since the muscle will respond only to direct stimulation.

Muscular fatigue is caused partly by the accumulation of waste products due to degeneration of the tissue, and partly by using up the stored nourishment in the tissue. If the waste products are washed out by a dilute salt solution, the muscle will respond again to stimulation.

Investigations made on animals show that toxins appear in the blood and affect tissues of all kinds. Blood transfused from a fatigued dog to a rested one will produce nearly all of the effects of fatigue. The waste products and toxins first cause increased excitability of a muscle which is later followed by diminution in excitability until the muscle becomes insensitive to further stimulation.

Much of school fatigue is caused by unhygienic living conditions, improper habits, sensory defects, and a lack of interest in school work. It is perfectly obvious that to reduce fatigue or ennui, the physical conditions should be corrected and the school work should be made vital to the nature and interests of the children.

Strong emotions tend to increase sensitivity to fatigue, while the mild, pleasant emotions or feelings tend to decrease fatigue.

Children differ greatly in the amount of work which they can do without showing the effects of fatigue. Health, method of work, and interest are factors which largely determine the amount of fatigue produced in an individual by a given piece of work. Work on the level of habit does not cause fatigue as readily as difficult mental or physical work.

Influence of Drugs on Efficiency. Caffeine is a drug found in coffee. A cup of coffee contains from one to two grains of this drug. Many believe that a cup of this beverage increases ability to do mental work. One investigator maintains that when caffeine is given either in small or large doses, mental efficiency is increased for periods up to seven hours. The good

or harmful effects of coffee are perhaps psychological as well as physiological.

Tobacco contains nicotine, which is a powerful drug. Smoking decreases muscular precision. The more one smokes, the greater is the loss in motor precision. Many believe that tobacco has a deleterious effect upon mental achievement as well as on motor precision.

Alcohol has a depressing effect on mental and motor efficiency, whether it is given in small or fairly large doses. The loss in mental and motor efficiency is somewhat in proportion to the dose.

The Learning Process in Human Society. It is of little concern to study the learning of an individual except as he is related to various social groups. Progress is essentially a learning process. Man gradually learns better ways of living through the control of conditions about him and of his own behavior. Progress of increasing control depends upon human inventiveness and that inventiveness depends upon imagination and reasoning. "The learning process is the method by which humanity improves its social adjustments."¹

Questions and Problems

1. What is learning? Does the amoeba learn? Why or why not?
2. Distinguish between the learning process and the teaching process.
3. To what extent may educational psychology profit from studies made in the field of animal psychology?
4. Distinguish between active and passive learning.
5. What are the laws of learning?
6. What is a learning curve?
7. What are the causes of irregular progress in learning?
8. How may plateaus in the course of learning be prevented or shortened in the case of their appearance?
9. What are the different kinds of learning?
10. Why is it advisable to distribute repetitions over several days or weeks rather than to mass the repetitions at one sitting?

¹ Ellwood, *Psychology of Human Society*, Chap. XIV, p. 447.

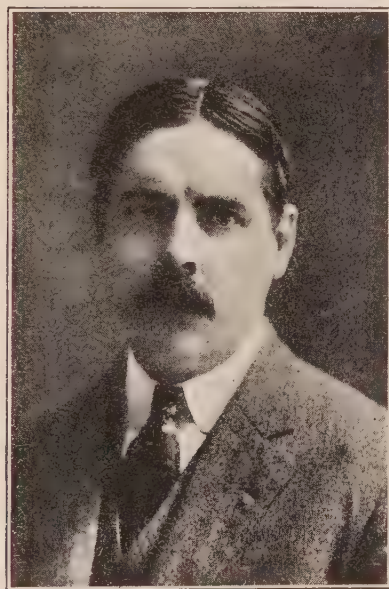
11. Why is it generally inadvisable to use "crutches" in learning?
12. Success bringing responses are highly satisfying. Explain.
13. Why does a dominant purpose or mind-set-to-an-end facilitate learning?
14. What are the functions of purpose?
15. How is learning influenced by the following:
 - a. Knowledge that one is making progress.
 - b. Knowing that one will be held responsible for what is learned.
 - c. Interest.
 - d. The "will to learn."
16. Explain the ineffectiveness of nagging.
17. Explain the fact that people learn to ignore the disagreeable features of colors, sounds, and odors.
18. Comment on the statement that "few pupils, if any, reach their possible limits of improvement."
19. Discuss the "hygiene of learning."
20. May learning in one subject facilitate or inhibit learning in another subject? Explain why or why not.
21. Discuss the advantages and disadvantages of school marks for motivating learning:
22. How may standard educational tests and scales be used so as to facilitate learning? What are individual progress records?
23. Distinguish between focal and marginal (or concomitant) learning.
24. To what extent, if at all, should teachers' promotions be based upon the amount which the children learn?
25. Discuss the following topics:
 - a. Individual differences in learning.
 - b. Relation of intelligence to learning.
 - c. Attitudes and learning.
 - d. Influence of fatigue on learning.
26. Enumerate as many principles of learning as you can. Cite examples from your own experience how they have been violated.
27. A project has been defined as "a unit of purposeful activity." Why has the project method much to recommend it.
28. Should misspelled words be presented along with the correct form? Give reasons for your answer.
29. In trial-and-error learning what are the steps in the learning process?
30. "Practice makes perfect" is an old maxim. Criticize it.

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CHAPTER IX

TRANSFER OF TRAINING

The Problem Stated. The problem of transfer of training may be stated in the following words: Will the formation of one habit either help or hinder in the formation of another? Are the results of learning narrow and specific, or are there general effects also? Will practice in one mental function influence other mental functions? In other words, does the child in the school gain only specific information, or does he acquire abilities and power which will help him in meeting situations outside of the school? Does learning in one situation result in a saving of time and effort in learning in other situations?

Mental Discipline. The doctrine of *mental or formal discipline*, as it was erroneously called, was that mental power, however gained, that was applicable in all sorts of situations. The theory asserted that mental power developed in one subject is usable in any other. It was thought by some that the more difficult and the more impractical a subject, the more mental power would be developed through its study, and consequently such subjects should have a large place in the school curriculum. The following is a statement of a typical defender of the doctrine of formal discipline: "I have no hesitation to assert dogmatically that Latin and Greek, French and German, higher mathematics, philosophy, the critical study of the literatures and histories of different nations, and the theoretical aspects of economics, politics, and biology, and the English grammar and rhetoric are among the most valuable subjects for developing thinking ability and mental power."

It may be of interest to consider at this point the historical

development of the doctrine of formal discipline. "The doctrine of formal discipline was implied in the educational practice of the Greeks and the Romans, gymnastics, music, and oratory being used to furnish a general physical and mental discipline applicable to all the needs of individual and civic life. The doctrine was at the basis of the ascetic discipline of the medieval monastics, who sought a complete development of the soul at the expense of bodily desires. It dominated the ideals and methods of scholastic education, with the drill upon the trivium and quadrivium culminating in the barren formalism and logical subtleties of university disputations, the ideal example in the Middle Ages of general reasoning power. But the doctrine was first clearly formulated as an educational theory in the seventeenth century, especially by Locke. Though it served as a defense of mathematics, its special purpose was to uphold the classical studies, when their intrinsic value had been greatly reduced by the use of the national vernaculars in literature, government, and education, and when the current emphasis upon them had been criticized by the growing spirit of realism in educational thought."¹

That not all of the older educators were extremists in their support of such a doctrine is evident if we examine Locke's *Thoughts Concerning Education*. Indeed, many of his statements ring true in the light of modern scientific inquiry. A few quotations will suffice to show his general position. He writes: "I hear it is said that children should be employed in getting things by heart to exercise and improve their memories. I could wish this were said with as much authority of reason, as it is with forwardness of assurance, and that this practice were established upon good observation more than old custom; for it is evident that strength of memory is owing to a happy constitution, and not to any habitual improvement got by experience. 'Tis true, what the mind is intent upon and, for fear of letting it slip, often imprints afresh on itself by frequent reflection, that it

¹ Heck, *Mental Discipline and Educational Values*, pp. 12-13.

is apt to retain, but still according to its own natural strength of retention. An impression made on beeswax or lead will not last as long as on brass or steel. Indeed, if it be renewed often, it may last the longer; but every new reflecting on its new impression; and 'tis from thence one is to reckon if one would know how long the mind retains it. But learning pages of Latin by heart, no more fits the memory for retention of anything else than the graving of one sentence in lead makes it the more capable of retaining firmly any other characters. If such a sort of exercise of the memory were able to give it strength and improve our parts, players of all other people must needs have the best memories and be the best company. But whether the scraps they have put into their heads this way makes them remember other things the better; and whether their parts be improved proportionably to the pains they have taken in getting by heart others' sayings, experience will show. Memory is so necessary to all parts and conditions of life, and so little is to be done without it, that we are not to fear it should grow dull and useless for want of exercise, if exercise would make it grow stronger. But I fear this faculty of the mind is not capable of much help and amendment in general by any exercise or endeavor of ours . . . And if Xerxes was able to call every common soldier by name in his army that consisted of no less than one hundred thousand men, I think it may be guessed, that he got not this wonderful ability by learning his lessons by heart when he was a boy . . . What the mind is intent upon and careful of, that it remembers best, and for the reason above mentioned, to which, if method and order be joined, all is done, I think, that can be for the help of a weak memory; and he that will take any other way to do it, especially that of charging it with a train of other people's words, which he that learns care not for, will, I guess, scarce find the profit answer half the time and pains employed in it."

There are certain fallacies in the theory of formal or mental discipline. The doctrine was based upon an antiquated psy-

chology known as "faculty psychology," which held that the mind was composed of many faculties or powers, such as perception, memory, judgment, reasoning, will, attention, imagination, and so on. It was thought by some that these faculties were more or less independent of each other, and that they could be improved by training. Thus, "learning by heart" — useless as well as useful matter — was claimed by some to be excellent in training the memory, and mathematics was thought to be especially suitable for the development of reasoning power. Locke, as suggested above, objected to forcing children to "learn by heart" material that was not worth remembering, and to the learning of lessons by memorizing without understanding.

With the collapse of "faculty psychology," the doctrine of formal discipline should also have died. But such was not the case, perhaps because there is considerable truth to the doctrine after all. "It is not all mistake and delusion." Indeed, the "formal disciplinarians" of past days, even when wrong in their premises, were right in many of their conclusions regarding the disciplinary value of subjects and the extent to which these values may help in the mastery of other subjects.

The Reaction to Formal Discipline. Early in the twentieth century a number of writers attempted to repudiate the doctrine of formal discipline. In so doing, they greatly exaggerated the case against it. Some went to such extremes as to declare that the doctrine was all wrong and that training in one subject was worthless in all others. The pendulum had swung to the opposite extreme. After all, the reaction against the discipline theory was due more to the connotation implied in the common use of such terms as "mental discipline" and "transfer of training," than to the theory itself. The solution to this age-old controversy over mental or formal discipline has been made possible by the advent of modern laboratory methods. Moreover, the term "transfer of training" has superseded "discipline." The new term "squares" with the facts; the old

term could not be saved because of the wrong implications historically involved.

The Experimental Evidence. Before forming a definite opinion regarding transfer, it is advisable to consider the experiments performed in this field. Experimentation has been limited almost wholly to the twentieth century. There have been many investigations, but the question has not been definitely settled in all of its aspects. Few experiments have been performed with sufficient thoroughness and attention to scientific detail to merit the respect of the impartial investigator. In carrying out an experiment in this field, it is necessary to have two groups as nearly equal in capacity and attainment as possible, one the "control," and the other the "practice" or "experimental" group. Both groups, after equating, are given initial tests, then the experimental division is submitted to training while the control group follows its usual course of activity. After this, final tests are given to both groups, and the differences in results, if not otherwise accounted for, are attributed to the training received.

One of the first men to work in this field was James. He memorized in the course of eight days 158 lines of Hugo's *Satyr*. This required $131\frac{5}{6}$ minutes. He then spent twenty minutes a day for thirty-eight days learning the first book of Milton's *Paradise Lost*. At the end of this time he again memorized 158 lines from Hugo, and found that it took him $151\frac{1}{2}$ minutes. His explanation was that he was fagged out by the other work at the time of the second memorization of Hugo, and that this was not a fair test. He repeated the experiment on four of his students with the following results: three of them shortened their time, but one of them required .3 of a minute longer per day. This experiment is of interest and importance owing to its historical significance in attacking the problem experimentally.

Among the early investigators Ebert and Meumann concluded that there was a positive transfer, and that it was due to

a mysterious "spreading" of effects from one field of physical or psychic activity to another. Those who have studied their experiments rejected the explanation of a sympathetic spread of effect, attributing the apparent transfer to increased power of attention, increase in voluntary effort, and improvement in the technique of learning. That the high transfer effect reported by the experimenters, 70 per cent, may have been only apparent is due to the fact that no control group was used in this experiment.

The most extensive experiments on the transfer of memory training have been performed by Fracker, Winch, and Sleight. Fracker trained a group in memorizing the order of four different intensities of the same tuning and determined the spread of improvement to similar performances, such as memory for four shades of gray, and to dissimilar performances, such as memory for poetry, geometrical figures, etc. In the similar memorizing, the improvement in the ability of the experimental group was 16 per cent more than that of the control group. In the dissimilar memories, this improvement was 3.75 per cent more than the control group. "Winch investigated transfer of memory in London school children. The practice test consisted of memorizing poetry, and the transfer to memory for prose material in geography and history was determined. In one series of experiments the practice group was found to excel the control group by 10 per cent, and in another series by 5 per cent." ¹ A second series of experiments was given by Winch in which the training group was practiced in the rote memorizing of meaningful and meaningless material, and the transfer of training to substance memory was determined. The amount of transfer was very slight, the residual gain over the control group being about 3.3 per cent of the initial ability.

The most extensive and careful experiments on the transfer of memory training are those of Sleight.² He trained three

¹ Averill, *Elements of Educational Psychology*, p. 357.

² Sleight, W. G., "Memory and Formal Discipline." *British Journal of Psychology*, Vol. IV, pp. 386-457, 1911.

different groups, one in learning poetry, one in learning tables, and another in memorizing prose. Initial and final end tests were given in ten different aspects of memorizing. His results showed that training in one aspect of memorizing gave little or no improvement in other types of memorizing. He also showed that practice in learning poetry and tables gave facility in learning dates but not in learning prose material. Practice in learning poetry gave more facility in learning nonsense syllables but very little more in learning tables than the unpracticed group gained, and not nearly so much gain in learning prose material as was gained by the unpracticed group. All the experiments on memory result in substantially the same conclusions. They indicate that experience in one type of learning may either facilitate or hinder another type.

A number of experiments were conducted to determine the transfer in discriminative judgments. Coover and Angell¹ investigated the transfer of practice effects in sound to light discriminations, and in card-sorting to typewriting. "In the first experiment four subjects were trained in discriminating sound intensities, each subject making judgments on each of seventeen days' training. The end tests used were tests of discrimination of grays, 105 judgments being made on each of three separate days before and after the practice tests. Control subjects were employed as a check, and it was found that three out of the four subjects made a residual gain in gray discrimination of 7 per cent, 5 per cent, and 15 per cent respectively, while the fourth subject actually lost. The experimenters concluded that the gain recorded was due in great part to habituation and to a more economic adaptation of attention, i.e. improvement was general rather than specific in character."² In the second experiment four subjects were trained for four days in card-sorting, and the end tests used were typewriting exercises. Improvement was

¹ Coover and Angell, "General Practice Effect of Special Exercise." *American Journal of Psychology*, Vol. XVIII, pp. 328-340, 1907..

² Averill, *Elements of Educational Psychology*, p. 354.

shown as a result of the practice in card-sorting, due to the habit of more direct and immediate reaction to the stimulus.

"Thorndike and Woodworth¹ gave subjects practice in estimating various types of magnitude, such as lines, surfaces, and weights. They found the effects of practice very narrow. Training in the estimation of the lengths of lines gave facility in estimating similar lengths, but not in the case of lines very much longer or shorter."² Judd found that practice in judgments of location of lines in one position facilitated similar judgments when the lines were in different positions. There has not been sufficient repetition of experiments in the field of discriminative judgments to settle the question of the extent of transfer.

There have been several experiments on cross education or the improvement of an activity involving one part of the body as the result of improvement through practice in a similar activity involving a bilaterally symmetrical part of the body. "The improvement in the second activity in such experiments can be explained as due to two causes. In the first place, both activities are very similar, and probably involve in part the same centers in the nervous system. Though bilaterally symmetrical parts of the body are controlled in part through cortical centers in different hemispheres, they are also probably controlled in part through lower centers which serve for both sides of the body. The improvement in the second activity is therefore probably due to the use in part of the same centres in both activities. In the second place, the improvement is due to the working out, in connection with the first activity, of a method of how to perform the act, and then to the use of this method in guiding the second activity."³

Rugg⁴ gave a group of 326 engineers in the freshman class at

¹ Thorndike and Woodworth, "The Influence of Improvement in One Mental Function upon the Efficiency of Other Functions." *Psychological Review*, Vol. VIII, pp. 247-261, 348-375, 553-564, 1901.

² Pyle, *Psychology of Learning*, p. 225.

³ Heck, *Mental Discipline and Educational Values*, pp. 65-66.

⁴ Rugg, *The Experimental Determination of Mental Discipline in School Studies*.

college a series of tests before and after a semester's training in geometry. The results of these tests were compared with those obtained from a control group of 87 subjects (72 of whom were in the School of Education) who did not study geometry but were given the initial and final tests. Each test was composed of five parts, as follows:

1. Division, such as divide 67 by 9, etc.
2. Division, such as divide 579 by 3, etc.
3. Word-building, making as many words as possible from the letters contained in m-a-t-e-r-i-a-l.
4. Painted cube test. A three-inch cube, painted on all sides, is cut into one-inch cubes. How many one-inch cubes have paint on three sides? On two sides? On one side? On none?
5. Tests in geometrical thinking, as "Form a mental picture of each object and count the number of straight lines which it would take to construct each one in space."

In the first part, division, the control group excelled the geometry group in improvement, but by only 1.1 per cent. In the other parts, the geometry group exceeded the control group, in the following manner: in the second part, division test, by 15.8 per cent, in the word-building part by 19.4, in the cube part by 14 per cent, and in the test of geometrical thinking by 48.5 per cent.

Rugg then concluded that the geometry training only improved efficiency in problems whose visual content resembled that of the training course itself.

Another very interesting study was made of the effect of a knowledge of Latin upon the ability to spell English words by submitting a list of fifty words of Latin origin to 324 freshmen at the University of Illinois. Rugg gives the following table:

Years of Latin	0	1	2	3	4
Number of Students	90	41	95	54	44
Average	82.1	82.4	80.2	81.5	90.1

The next step was the giving to the same group of students ten

words of Latin origin which were to be defined. The results were:

Years of Latin	0	1	2	3	4
Number of Students	90	41	95	54	44
Average	30.5	44.2	45.9	53.0	85.3

The grades in rhetoric of students who had had various amounts of Latin were also compared and revealed:

Years of Latin	0	1	2	3	4
Number of Students	53	41	66	28	26
Grade	72.2	79.2	79.5	80.6	81.8

The conclusion was that in all fields the four-year Latin students showed a marked increase over those who had studied Latin for a shorter period. However, no allowance was made for the possibility that those who survived four years of Latin were natively superior to the other students.

Bagley made an experiment, under school conditions with school subjects, in which the classes were trained to improve the neatness of their arithmetic papers. After considerable training, their geography papers were examined to see whether these papers had also improved in neatness, but it appeared that the improvement gained in the neatness of the arithmetic papers was not transferred, or carried over, to the geography papers.

An interesting experiment was performed by Scholckow and Judd. Two groups of boys were asked to hit a target which was submerged in twelve inches of water. One group had studied physics and understood the law of refraction; the other group was ignorant of the existence of any such law.

The results of the first trials were about the same. Neither group showed any marked ability and the scores were almost alike. The target was raised so that it was submerged in only four inches of water. At this point there was a wide divergence in results. The group which had the advantage of a course in physics made much better scores than the uninformed group. This latter group could not understand the reason for their in-

ability to hit the target nor could they adapt themselves to the new situation. The informed group, however, readily adjusted their aim.

In his *Experimental Determination of Mental Discipline*, Professor Rugg summarizes the work done up to 1916 in this field. On the whole, the experiments substantiate the existence of transfer, or disciplinary values.

Transfer in High School Subjects. One of the best experimental studies of transfer of training from the point of view of extent and natural background is that conducted by Thorndike in 1922-1923. Over eight thousand children acted as subjects, and what is more, they had no knowledge of the fact that they were subjects. These children were practiced in their actual school work. The function that was tested with a view of detecting transfer, was the power to obtain high marks in portions of the Institute of Educational Research Intelligence Test. The children were given the test at the beginning and at the end of the school year. Naturally they improved their scores on the second occasion as compared with the first. The question was whether some of the school subjects had improved their ability more than others.

From all the children acting as subjects two groups were selected who were taking the same school subjects, except that one took, say, Latin where the other took, for example, cookery. Only one subject was to be different in the two groups. In this way differences, if any, between the two groups may be supposed to be caused by the one subject which differs.

Suitable precautions were taken to insure carrying out the experiment as scientifically as possible. Perhaps the chief objections that may be raised would be that the *test* is artificial and unlike real life tests, that it was short, and that the tests had to be performed with a time limit at a certain place and on a certain occasion.

On the whole, Thorndike must be granted his claim to have shown that transfer is not easy to detect, as it ought to be if it

occurred on a wholesale scale. The results, showing the relation of studies to gains made by the relative frequency of the study in groups making various amounts of gain, arranged in descending order from high value to low value were: French, chemistry, trigonometry, German, physics, general science, Latin, book-keeping, physical training, arithmetic, geometry, algebra, history, music, shop, Spanish, English, drawing, business, civics, biology, dramatic art, stenography, economics, cooking, sewing. The tables show that there is a possible relation between the presence of French or chemistry in a pupil's program and gain in the test, and a negative relation between the presence of cooking and sewing in a pupil's program and gain in the test. In the case of shop, Spanish, or drawing there is zero relation approximately, these studies being as frequent in the programs of children who gain little as in those who gain much. The superiorities of French, chemistry, and trigonometry were such as would be produced if taking these subjects increased a pupil's gain the respective number of points over what it would be if he had taken an average mixture of studies in place of the French or chemistry or trigonometry. The inferiority of dramatic art to stenography as shown in the same tables is such as would be produced if taking one of these studies instead of an average mixture of studies reduced a pupil's gain by so many points respectively. The meaning of his results may be made clearer by the following example: Thorndike finds that one year's study in either algebra or geometry as now organized does increase one's ability to think by a small degree. He finds that the gain is no larger than that due to the study of other subjects as they are now organized. Strangely enough, bookkeeping, biology, cooking, and sewing increase one's ability to think as much or even more in some cases than does the study of mathematics or the classics. We shall let Thorndike¹ give in his own words some of his conclusions and interpretations.

¹ Thorndike, "Mental Discipline in High School Studies." *Journal of Educational Psychology*, Vol. XV, pp. 1-22; 83-98, 1924.

"It should be noted that the facts . . . are not in opposition to the theory that general improvement of intellect results from school studies, and that studies vary in their value in this respect. The question is one of quantity. The traditional theory was: (1) that the amount of general improvement due to studies was large; and (2) that the differences between studies in respect of it were large, so that the value of a study as training for the intellect was of very great importance relative to its value as special training in mathematical or linguistic or spatial or other thinking; and that (3) mathematics and languages gave much more of this general improvement than other studies did. The facts of Table XVI [not reproduced here], if corroborated by similar experiments, prove that the amount of general improvement due to studies is small; that the differences between studies in respect of it are small, so that the values of studies may be decided largely by consideration of the special training which they give; and that the languages have no claim to preëminence . . .

"By any reasonable interpretation of the results, it appears that the physical sciences are equal, if not superior, to languages and mathematics as now taught in our American cities, in respect of mental discipline from any point of view. The social studies, including history and English, would probably make a better showing than they do if the examination tested thinking with respect to broad questions of human nature, morals and community affairs, instead of some of its linguistic and numerical items. I doubt, however, whether the difference is wholly due to the content of the test. Something must probably be conceded to the more rigid and systematic and abstract nature of the thinking in mathematics, grammar, and physics as compared with that in English and history. As already suggested, the biological sciences probably suffered in a similar manner from the limitations of the tests.

"By any reasonable interpretation of the results, the intellectual value of studies should be determined largely by the special

information, habits, interests, attitudes, and ideals which they demonstrably produce. The expectation of any large differences in general improvement of the mind from one study rather than another seems doomed to disappointment. The chief reason why good thinkers seem superficially to have been made such by having taken certain school studies, is that good thinkers have taken such studies, becoming better by the inherent tendency of the good to gain more than the poor from any study. When the good thinkers studied Greek and Latin, these studies seemed to make good thinking. Now that the good thinkers study Physics and Trigonometry, these seem to make good thinkers . . . After positive correlation of gain with initial ability is allowed for, the balance in favor of any study is certainly not large. Disciplinary values may be real and deserve weights in the curriculum, but the weight should be reasonable."

The Judgment of Psychologists and General Conclusions. Nearly all the psychologists who contributed to the symposiums on transfer of training in connection with the Classical Investigation, and the Report by the National Committee on Mathematical Requirements under the auspices of the Mathematical Association of America, on the subject of The Reorganization of Mathematics in Secondary Education, expressed the opinion that mental functions under certain conditions are subject to spread or transfer. Only a few of the psychologists believe in automatic transfer, (i.e. without conscious adaptation of content and method to this end). All are agreed that the extent and amount of transfer can be increased in proportion to the extent to which favorable conditions are provided. Of these the majority expressed the opinion that conscious generalization is essential or desirable. This means that *if considerable spread is to be assured, the common element to be transferred must be brought specifically to the child's attention and generalized into a principle, and the application of the principle to other fields must be emphasized and made clear.*

The real problem of transfer is a problem of organizing the method of training so that it will carry over in the minds of the students to other subjects and activities.

The investigation of transfer by the Committee on the Reorganization of Mathematics in Secondary Schools¹ proceeded along the following lines: "(1) A study of the experiments and discussions of psychologists on the subject of transfer was made. (2) A set of statements of what are thought to be logical inferences from these experiments and discussions was drawn up. (3) The opinions of forty of our leading educational psychologists with regard to the truth of these statements was solicited. (4) An analysis of the replies and an attempt to formulate conclusions from them has been made."

The principal facts, drawn from the results of these experiments, from which later inferences have been made, are the following:

1. A very great majority of the experiments show transfer of training.

2. Under constructive criticism certain defects in the experiments have been pointed out, and consequent improvements made in their technique. The school room as well as the laboratory is now used as the place of experiment, and children as well as trained adults serve as the subjects of experiment. The material used in the training has changed also. School subjects have largely replaced the artificial materials formerly used.

3. Many of the experiments have dealt with mental functions which would not be likely to show much transfer even under the best of conditions.

4. The more objective the relation between the matter of the training and that of the tests, the more noticeable the transfer, especially in cases where the training was narrowly specific.

5. Negative transfer, or interference owing to practice, is occasionally found.

¹ Report of the Committee on the Reorganization of Mathematics in Secondary Schools, Part II, 1922.

6. Carefully controlled studies directed toward the conditions of transfer show that certain concomitants of specific training are operative in bringing about transfer, among which are: (a) the development of an ideal; (b) understanding of the method of procedure; (c) conviction of the worthwhileness of the training; and (d) maintenance of a high level of attention.

7. The relation of abilities of students in school subjects is sufficiently close to make it not impossible that their training in one subject is influencing their performance in others.

A Formulation of Inferences. From the general considerations listed above the following seven statements were formulated and submitted to psychologists for their consideration. The psychologists were asked for any further information they would be willing to give, and it was hoped that a free expression of opinion on their part in regard to any debatable point would tend to obviate some of the objectionable features of a questionnaire.

1. Transfer of training is an established fact, and may be positive, negative, or zero.

2. The true amount of transfer from one field to another has not yet been found by experiment, on account of one or more of the following handicaps:

a. The maturity or the previous training of the subject tested.

b. The absence from the training of the factors most favorable to transfer.

c. The inadequacy of the tests to measure the traits sought.

3. It is a reasonable inference that a substantial amount of transfer to some related field would be found by an adequate test, if in teaching children emphasis were placed upon the trait which the selected subject was most capable of developing, and if the factors controlling transfer were present in the training.

4. Even if no great amount of transfer of training to any one field should ever be found by experiment, it would still be true that if small amounts of transfer of a valuable trait ex-

tended to a large number of fields, the sum total of all these small amounts would be a very valuable educational asset.

5. Negative transfer or interference may take place when, in the training of a certain trait, auxiliary habits are cultivated which have to be broken down before the trait can function in a new situation.

6. Zero transfer may occur when the habits tending to interfere, and those tending to transfer, just offset each other.

7. There are elements of situations so fundamental in their nature that they occur again and again in connection with almost anything else. Special training with these elements has general value.

The general conclusions drawn from this study and from the comments which some of the psychologists added to their answers may be stated as follows:

1. The two extreme views for and against disciplinary values practically no longer exist. As the question now stands, as to transfer of training, the psychologists quoted here almost unanimously agree that transfer does exist.

2. A large majority agree that there is a possibility of negative transfer, and of zero transfer, caused by interference effects. Professor Thorndike is of the opinion that negative transfer is comparatively rare and can be avoided by proper methods of training.

3. Very few if any experiments have shown the full amount of transfer between the fields chosen for investigation. The reason for this is to be found in the imperfections of the experimental setting. Of the defects mentioned in Statement 2, absence from the training of the factors most favorable to transfer is the one most generally considered important, though strong emphasis is placed in several instances upon the inadequacy of the tests.

4. The amount of transfer in any case, where transfer is admitted at all, is very largely dependent upon methods of teaching. This is probably the strongest note struck by the psychol-

ogists in their comments. Twelve of them out of twenty-four make some explicit reference to the matter.

5. A majority of the psychologists, judging from their remarks seem to believe that, with certain restrictions, transfer of training is a valid aim in teaching.

6. Transfer is most evident with respect to general elements, ideas, attitudes, and ideals. These act in many instances as the carriers in transfer. Often they form the common element so generally held to be the *sine qua non* of transfer. Twenty-two of the twenty-four psychologists express the opinion that special training in connection with these elements has general value; and one of them, Professor Sanford, adds: "This I believe to be true, and to be the basis of the generally held belief among practical teachers of the existence and value of 'formal training.'"

To guarantee any transfer, the element to be transferred must be brought specifically to the pupil's attention, generalized into a principle, and the application of the principle to other fields made clear. For example, if neatness is trained in written arithmetic work, the value of neatness must be discussed and the ways in which neatness is secured made plain and more than a mere rule of thumb; it should be reduced to general principles, and conditions of neatness in other fields should be made plain. In short, the matter to be transferred must be made the specific subject of study.

It is unnecessary to multiply examples in the experimental field, or to submit further evidence to permit the drawing of general conclusions. It is generally agreed that there is some transfer of training. The amount of transfer is not the same in all cases, but in most experiments, transfer of ability has been found. Furthermore, there is far from complete transfer; the amount is not so great as was formerly supposed by the advocates of the mental discipline theory. In addition, the amount of transfer varies widely with the conditions. "It varies both with the kind of function which is trained, and the kind of

subject-matter which is used, and the way in which the training is given and the capacity and attitude of the learner.”¹

Theories of Transfer. Having now arrived at the conclusion that transfer exists to some extent, the question that concerns us is the method by which transfer is secured. The explanation of transference of training most commonly accepted today is that proposed by Thorndike known as the theory of identical elements. According to this interpretation, improvement in any given mental function rarely if ever results in the improvement of any other mental function. It is believed that when improvement in learning a given activity is shown to occur as a result of practice in another activity it is because of identical elements or a similarity which exists between the two. Thorndike, Woodworth, Starch, and Sleight are prominent advocates of the spread of training where identical elements exist. All psychologists apparently hold that where there is identity or close similarity of content material or method of procedure, improvement increases according to the general laws of learning up to a physiological limit. By identical elements are meant processes which have the same cell action in the brain as their physical correlate.

Judd thinks that the author of the theory of transfer by “identical elements” finds it inadequate, since Thorndike says, “The general theory . . . is sound, and is useful in guiding thought. However, so little is known about which neurones are concerned in any ability that this general theory does not carry us far.”² Although there are identical elements in given situations, the extent to which the mind can generalize is the extent to which the elements may be utilized. “The important psychological fact . . . is that the extent to which a student generalizes his training is itself a measure of the degree to which he has secured from any course, the highest form of training.”³

¹ Freeman, *How Children Learn*, p. 266.

² Judd, *Psychology of High School Subjects*, p. 419 (quoted from Thorndike).

³ *Ibid.*, p. 413.

There is no essential divorce between the theory of identical elements and the theory of generalization. The important difference is in the emphasis that is placed upon the conscious recognition of identical elements in as many situations as possible.

Bagley¹ conceives transfer to occur through development of ideals that arise through conscious generalization of various situations. He gives the classic illustration, that neatness in arithmetic does not necessarily carry over to new situations unless the ideal of neatness is consciously developed in the mind of the child. The growth of an ideal is possible only through conscious generalization, and it is in this respect that Bagley's theory resembles that of Judd.

Spearman's "theory holds that any one's ability in any particular form of mental activity is the sum of two factors, one general and common to all mental processes, the other specific and peculiar to that particular activity." Thus this theory embodies the best in the theories of both Judd and Thorndike.

The configuration theory of Koffka is that transfer is secured through a pattern in which the elements fit in according to their relation to other elements and to the whole. When the parts enter into another configuration like the original, there is transfer.

Liberal Education and Transfer. The value of a liberal education has been shown in the writings of Pillsbury and Bagley. The latter believes that principles are more valuable than specific methods, and that adaptive controls outweigh specific controls. Pillsbury has given the discussion an interesting turn as shown by the following significant statement: "You cannot be sure that any fact is absolutely unrelated to any other, and so far as they are related, learning the one makes easier learning the other . . . Training one part thus trains related parts, and the whole in some degree . . . So the man

¹ Bagley, W. C., and Squire, C. R., "Experiments on Transfer of Ideals of Neatness," in Bagley's *Educational Values*, p. 188, 1905.

with well-rounded training is probably on the average better trained for learning in any field than the untrained man, or even than the man with a narrow education in any other field."

Teaching Suggestions. Transfer itself is not sufficiently vital to warrant the building of a curriculum upon it alone. The intrinsic value of the subject itself requires consideration. Other things equal, that subject which provides the greatest degree of transfer is preferable. In working out a curriculum one must study and test the elements competing for inclusion. The criterion to be used is the degree of correlation between that element and the environment. "In how many and in how many important ways (quantity and quality of usefulness) can the specific element be used by the pupil in adjustment to his environment? Here is our basis for comparison between elements, and there is no reason why each and every element of each and every study should not be subjected to such a comparison."¹ "It is important to lead pupils to recognize the various environmental relations and uses of the elements of subject-matter or of method which are brought into the school. If pupils are not thus guided they may fail to see these relations and uses and consequently may fail to apply the knowledge and abilities developed in school to those phases of the outside environment to which they should be applied."² It is useless to bring into school a relation which is not in the environment. Only those subjects which have the greatest quantity and quality of environmental usefulness should be brought into school.

To secure the greatest degree of transfer, not only content but method must be taken into account. "Methods of teaching should include the factors or some of the factors of transfer, if transfer is desired: there must be identity of content or of procedure, there must be ideals, generalizations, general methods, the development of attitudes or dispositions, and practice of the

¹ Heck, *Mental Discipline and Educational Values*, p. 165.

² *Ibid.*, p. 167.

desired activities in as many situations as possible . . . Not only is the method of teaching important, but the student should coöperate.”¹

In attempting to secure transfer the teacher should make those specific activities which she wishes to transfer, the object of thought. The children should be made conscious of the habit to be formed. They should be trained in the technique of learning and in the processes that make learning effective and economical. The teacher should see that the reaction should be a common element in many situations. Furthermore, education should cultivate through specific training general emotional attitudes. The right kind of transfer is valuable, even if the amount of it is not great, and it is largely up to the instructor to see that it is applied to many different situations of activities.

Transfer of training is a very interesting field of study, and, as has been shown, there are many different views held concerning the subject. But these different theories are not irreconcilable; each emphasizes a different aspect, but when they are taken together they seem to supplement each other. The experimental approach to the subject has shown that transfer does exist to some extent. The actual amount of transfer is probably greater than the investigators have shown. “Much of the transfer is potential, subliminal.”² General mental ability (intelligence) is based on the fact of transfer. With the more scientific development of experimental technique, probably new evidence will come to light which will help solve some of the problems connected with this field.

Questions and Problems

1. What is meant by “transfer of training”?
2. Distinguish between the “doctrine of mental (formal) discipline,” and transfer of training.

¹ Bolton, *Everyday Psychology for Teachers*, p. 140.

² Buckingham, B. R. “Concerning Transfer,” an Editorial. *Journal of Educational Research*, p. 292, April, 1928.

3. What was the conception of John Locke regarding transfer of training?
4. Make a list of the facts that have been established by experimental studies in this field.
5. How do psychologists account for transfer of training? Contrast Judd's and Thorndike's explanation of transfer.
6. Under what conditions is transfer most likely to occur?
7. Should teachers aim to teach in such a way as to secure a maximum of transfer? Why or why not?
8. How would you account for the fact that psychologists are not entirely agreed on all of the points concerning transfer? Do you believe that the differences of opinion are fundamental, or are the differences primarily owing to an individual slant from which the problem is viewed?
9. To what extent should transfer of training condition the selection and organization of subject matter, and the technique of teaching?
10. Make a summary of the chapter.

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Charles Hubbard Judd

CHAPTER X

THE PSYCHOLOGY OF MOTIVATION

WHY do human beings behave as they do? This is the problem the psychology of motivation undertakes to explain. As has been noted in earlier chapters, there are internal causes for many types of behavior over and above the stimuli received from sense organs at the surface of the body. *Motives* is a term that applies to internal processes or drives, such as desires, cravings, wants, and urges. Motives are fundamentally physiological in character. Man, for example, behaves as he does because he is equipped with bodily mechanisms for perceiving, thinking, striving, and purposing, and for experiencing such emotions as fear, rage, and love.

In addition to the fundamental physiological drives, there are certain social influences that explain in part why individuals behave as they do. Even many of the most essential wants become highly socialized. Hunger and sex functions are typical examples. The former becomes a highly socialized function; the latter, socialized and regulated by society to such an extent that people often fail to recognize sex motives even when they actually dominate behavior.

Drive and Mechanism. The drives, desires, cravings, urges, wants, or motives ¹ of man explain in part why he behaves as he does, while the specific mechanisms involved explain how the activities are accomplished.

The stimulation of a sense organ sets up a nervous impulse

¹ These terms are often used interchangeably, although they do not have exactly the same meaning. Some writers prefer the term desire, others the term urge, and still others some other term.

which travels to the proper cerebrospinal centers and there connects with other nerves including the autonomic division which touch off reactions in various glands or muscles, or both. If different nerve impulses unite, the result may be a strengthening of the impulse. In other cases, there may be a weakening of the impulse or a tendency to inhibition. The motive force is not always the local stimulus. Indeed, in many cases other nerve centers may be aroused by other situations, and thus furnish the motive force for the center that is directly responsible for the reaction. Moreover, a nerve center once aroused to activity does not subside at once after a momentary discharge. Its state of activity may outlast the stimulus that aroused it, and thus residual activity may act as the motive or drive to another center; or it is possible for a center to be excited by an external stimulus that is not capable of arousing it to a full discharge. Thus, when partially excited, the center may influence other centers either by reinforcement or by inhibition. Sometimes one mechanism, when partially excited, becomes the motive power or drive of another. This fact is especially significant in the case of the so-called preparatory and consummatory reactions.¹ The latter type of reaction is of direct value to the organism. It brings immediate satisfaction as in the case of eating when hungry, or escaping from danger. Preparatory reactions are of less immediate benefit to the organism. Their value lies in the fact that they lead to and make possible the consummatory reaction. In the case of the preparatory reaction, a persistent inner tendency towards the consummatory reaction can be seen. Observe the hungry child that loses his half-filled nursing bottle. There seems to be some persistent inner tendency that drives him toward the consummatory reaction since "the hungry child does not stop to play." He keeps trying to find the bottle. If successful, he will experience immediate satisfaction. Drives or motives may be thought of as mechanisms already aroused, especially

¹ Woodworth, *Dynamic Psychology*.

these mechanisms that are directed towards consummatory reactions. They are to be explained in terms of visceral tensions and endocrinal (ductless gland) activities.

Number and Classification of Motives. Whether the number of elemental urges or motive forces can be reduced to two or three — the sex or “libido” motive, hunger, and the desire for death in old age — as Freud maintains, or that the number is innumerable, as James contends, will not be discussed here.

Motives are the resultant of growth and development from within owing to the combined forces of heredity and environment, and to the proper stimulus.¹ A *drive* is a definite reaction or tendency to reaction. It begins with the life impulse but may be modified by the environment. All motive forces, although fundamentally biological, are also very largely determined by social influences. All human motives reflect both the biological and the sociological aspects of human nature. Not all of them are equally recognizable. Some psychiatrists, and psychoanalysts explain certain activities in terms of defeated or baffled motives. Emotional complexes and conflicts, for example, may be resolved into a general inferiority complex. Physical inferiority may induce neurotic condition or tend to make one an unsocial being. Some individuals attempt to compensate for certain weaknesses by over-reacting.

Thorndike has long insisted that success in accomplishment is very often the determining motive in behavior. Success is satisfying, and the resultant satisfaction promotes the tendency to repeat the response and acts as a motivating force. Woodworth stresses this view in the following statement: “Almost any object, almost any act, and particularly almost any process or change in objects that can be directed by one’s own activity

¹ The writers are primarily motivists or modified behaviorists in their belief. Mental activity originates in the individual self rather than in the environment. All activities have their roots and beginning in the life impulses, energies, cravings, desires, purposes, and aspirations of the living dynamic self. The stimulus serves as a secondary or exciting cause. The experiencing organism is the connecting link between the stimulus and the response, and determines the nature of the response.

toward some definite end, is interesting on its own account, and furnishes its own drive, once it is fairly initiated." ¹

For practical purposes, the dominant wants or motives may be classified as follows:

1. Wants aroused primarily by organic conditions, i.e., hunger, thirst, sex, etc.
2. Instinctive tendencies.
3. Feelings and emotions.
4. Habits.
5. Attitudes, interests, ideals, purposes, morale, etc.
6. Unconscious forces.
7. Suggestion, sympathy, and imitation.
8. Intelligence and talents.

A more complete list has been prepared by Professor Gates.² He suggests, however, that many of the urges listed are not to be thought of as single and indivisible but rather as a name applied to a group of particular impulses which are more or less similar. Eleven urges are listed which are aroused primarily by organic conditions. To these he adds several others, the most important ones being: the urge to collect or hoard for its own sake; the urge to excel or succeed in general, such as to overcome obstacles, to resist domination by people, to dominate things, to dominate or master people, and to excel a competitor; the urge to fight when persistently thwarted or interfered with; the urge to secure sympathy; the urge to care for and protect children; the urge to be in groups; the urge to secure social approval; and the urge to avoid scorn. Biological urges to fight, hunt, and destroy for its own sake probably do not exist. Moreover, the urge to relieve suffering is weak and the urge to submit for its own sake is probably not generally strong. Considerable uncertainty exists about the relative strength of the urge to beget children. Much uncertainty also exists as to whether these

¹ Woodworth, *Psychology*, p. 202.

² Gates, *Elementary Psychology*, p. 226.

urges are native or acquired, excepting those which are aroused primarily by organic conditions which of course are native.

The fundamental urges influence behavior in many ways. In well-established habits, we find operations that are very similar to instinctive tendencies. The urges cannot always be allowed free expression. Society demands their control, and possibly, in some cases, their thwarting. Urges are therefore inhibited or modified by antagonistic urges; by acquired habits, ideals, conventions, and taboos; and by obstacles in the environment. As a result of such thwarting, various adjustments are made. Some individuals, especially those possessing a neurotic or psychotic constitution, find it difficult to make adjustments. Some of the most familiar ways wherein thwarted desires may be exercised involve the substitution of the imaginary for the real. As a result we find various forms of introversion, rationalization, defense, escape mechanisms, and compensations or substitute activities.

The natural drives or motive forces are the instinctive tendencies, native capacities, and especially the feelings and emotions which so closely accompany them. Thus, these forces are the basic motive forces or drives, and are the material from which purposes, ideals, and character of individuals and groups are gradually shaped under the guidance of attention, perception, imagination, and reason.

Native capacities and instinctive tendencies are not the only motive powers of the human mind to thought and action. Habits and attitudes constitute other very important classes of motive forces.

Instinct As a Drive. In our discussion of instinctive tendencies we saw what powerful forces they really are and how they account for much of man's conduct. In times of insecurity, the fear motive drives men together; the pugnacity motive bands primitive tribes together for group combat; the economic motive encourages industrial organization and coöperation; the self-assertive and submissive tendencies bring emulation and

initiative as well as obedience; the parental tendency broadens its scope to include others besides the helpless and leads to self-sacrifice and altruism. The tendencies to group together (gregariousness) and to engage in competition and conflict with other groups, make possible the existence of groups of all kinds.

The individual is naturally interested in doing the things for which he has the native capacity; and once his activities are aroused they furnish their own drive. The same is true of abilities developed through experience.

Feelings and Emotions As Drives. The feelings and emotions are very closely connected with our autonomic mechanism and instinctive equipment, and are consequently very powerful drives. It has been said that we can win over our enemies if we appeal to their honor and their feelings. The persistent objector to education can often be won. After a good meal, it is especially easy to talk over matters in a heart-to-heart fashion and drive home one's arguments with telling force. In fact, we must sell our goods, our programs, and our ideas primarily on the level of feeling rather than of logic. The teacher, for instance, can render greater possible service by means of aiding members of her class who are ill or in distress. The appeal should be made to higher and higher feelings and emotions. Fear and anger must give way to love, respect, and service.

Interest As Drives. Interests are primarily acquired forms of reaction; yet they root deeply into our instinctive nature. The number and kinds of interests which have strong motivating power are very numerous. Where interest is lacking, it may be developed. James pointed out some ways in which this can be done. He bids us to acquire interest in a topic or subject by attacking it vigorously, reading extensively on the subject, outlining it, talking to others about it, writing about it, and reading and reflecting still more about it. The learner who follows this procedure will soon be astonished to find that he is interested in the subject. Worthy interests should be a part of every individual's equipment.

Ideals, Attitudes, and Purposes As Drives. Ideals, attitudes, and purposes are drives of great importance. Each is very largely the product of training, and each represents an outcome that needs to be stressed more and more. That ideals can be inculcated through direct training has been demonstrated experimentally by Voelker. He shows conclusively that moral conduct and moral ideas can be developed simultaneously. These are discussed at greater length in a subsequent chapter.

Appeals. The human being is ever active and striving. He craves stimulation. Certain things give him greater stimulation than others. Any situation that is clothed in mystery and involves suspense leads the individual on and on. The public speaker who divulges all his "secrets" at the beginning of his lecture will be very ineffective. But the speaker who talks on a subject that is full of mystery and who holds his audience in suspense till the very end has control of his audience.

Appeals cannot be made successfully to any individual who has no felt need or want. A subscription book agent approaches a prospective customer who is not interested, and who does not want the book. The agent does not argue the case. He simply asks for the privilege of showing the sample. In brief, he proceeds to build up a want for the book where none exists in order to get the desired reaction — a sale.

Appeals to wants are always effective, while appeals to reason are effective, as a rule, when they are also appeals to a want.¹ During the late World War men in every nation involved were swept out of their ordinary pursuits into a matter of national concern by propaganda. When the propagandists made appeals to people's reason, they tried to get them to feel vividly that their deepest concern and most important want was to defend the homeland, to repulse the invaders, and to avenge the alleged wrongs perpetrated on women and children.

If appeals are made to fundamental wants, action is secured with little difficulty. Successful appeals are not made through

¹ Overstreet, *Influencing Human Behavior*.

the use of coercion. Individuals must be made to want to do what society approves. Whenever the want becomes sufficiently strong, action follows.

The advertiser of comfortable furniture makes appeal to the customer's desire for comfort. Other situations call for appeals to one's appetite, or devotion to one's friends. Not infrequently, appeal to several wants is more effective than appeal to a single want. Appeal to wants which people feel deeply and persistently are most fruitful in inducing them to act. No one wants sickness, boredom, and depression. No one lacks a want for affectionate devotion. Consequently, appeals to one's strength, health, interests, and desire to serve others are effective.

Not infrequently, people suffer from all sorts of fears, real and imaginary. Sometimes these fears are induced in part by superstitions, or religious teachings. Since people naturally avoid danger, appeals that give a sense of security are better than those which give no such security. A soothing, optimistic, and comforting attitude toward life is better than one which is not concerned with personal security.

People like to possess things. A teacher likes to own his own books. With his ownership goes freedom to use them when and how he pleases. This tendency in youth can be sublimated so that the tendency to own physical things or objects gives way to possession of intellectual and spiritual outcomes. Instead of seeking more postage stamps to add to a collection, the youth or adult may seek more information on a subject, or reflect upon ways and means of rendering greater service to the community or to humanity. Indeed, the want to possess is quite desirable so long as the object of possession is fundamental and wholesome. People should want to own their homes. They should want to have the best schools, play-grounds, recreation centers, and churches obtainable. They should want to provide their children with good books, good pictures, good music, and good friends,

Appeals that involve increase in efficiency, the saving of time, money, and energy are instant and strong. Likewise there is social pride. People desire the approval of those whom they respect, and of organizations and institutions to which they subscribe. Teachers, groups, agencies, and institutions wield a very powerful influence, therefore, in the form of approvals and disapprovals of conduct.

There is pride in one's personal appearance and one's cleanliness; there is satisfaction in being recognized, in having prestige. There is a want to find out about the new, the novel, and the unknown; there is a desire to be in style, to use proper manners; there is a powerful urge to make something, i.e. a radio, to play a piano or harp, or to organize a summer camp. There is joy in achievement, in overcoming obstacles, whether mere intellectual problems, the physical elements, or our fellowmen, and there are powerful desires for harmony with one's fellows and with the universe.

In general, effective motives are the avoidance of pain and annoying situations, and the securing of pleasure. Among the desirable motives are doing right for right's sake, and establishing common welfare.

A great deal of futile arguing would be disposed of if people would remember that "no appeal to reason that is not also an appeal to a want is ever effective." It ought to end a great deal of sarcasm and denunciation which we hurl at others. It ought to influence the preaching, scolding, and dictatorial parent to change his ways. It ought to suggest to teachers, social workers, the clergy, and reformers more effective methods for getting and holding the attention, and for changing human beings for the better.

Action is set off by our fundamental wants and desires. Reason is an instrument of action. It enables us to weigh and compare; to see where we are going and how we may best arrive. But if we do not actually wish to go, there will be no action. The want begets action; and as we have said repeat-

edly, the teacher must arouse in his student a real desire to know, a real wish to comprehend, and a real motive for doing; otherwise his efforts are largely in vain. He who can arouse in others an eager want, holds victory in his hands.

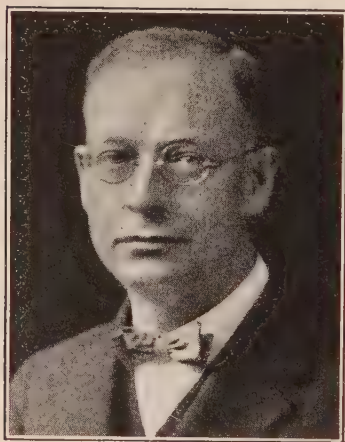
Questions and Problems

1. What are motives? What other terms mean about the same as motives?
2. What is the distinction between drive and mechanism? between preparatory and consummatory reactions?
3. Give an illustration of preparatory and consummatory reactions from classroom situations.
4. How may motives be classified?
5. Instinct tendencies are powerful drives to action. Explain.
6. Give an illustration of an ideal as a drive.
7. Distinguish between an appeal to a want and an appeal to reason.
8. What is the function of propaganda?
9. What laws and principles are used by propaganda?
10. Discuss the topic — Dynamic Psychology.
11. What are the springs or motivating forces of human behavior?
12. How may classroom work be motivated to greatest advantage?
13. Should material rewards be given to stimulate classroom work? Why or why not?
14. Should teaching devices be used to stimulate interest in drill work? If so, to what extent should they be used?

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CHAPTER XI

PERCEPTION AND IMAGINATION

THE sense organs are the gateways of the mind. Only through them are we able to get our basic experiences. The sense organs make possible our sensory experiences known as sensations and blends of sensations, but these would have no significance if the human being were unable to comprehend and interpret that which he senses. Each experience leaves a deposit which affects in part subsequent experiences. Thus the individual's power to unify and integrate experiences, plus his ability to retain impressions, gives rise to a type of experience more complex than sensation. These new experiences which involve meaning as well as sensation are called sense perceptions.

Along with the bodily development of the child there is a gradual perfection of sense organs and their connections. The manner in which an individual perceives, is partly a matter of growth, experience, and training of the attention.

Development of Percepts. The child's first experiences must be very different from his later experiences. Feelings of bodily comfort or sensations of pain are most prominent. His range of experiences is quite limited as well as vague and indistinctive. The things he first senses have no meaning for him. Out of this meaningless and confused state there gradually emerges the active, mentally alert, and clear perceiving mind of the adult. How does this wonderful transformation take place?

Sensations are assailing the infant all the time he is awake. Not all of these are alike. He sees, hears, handles, tastes, and

smells. He is constantly reacting to stimuli in different ways. Out of this vast wealth of sensations, in which the child instinctively delights, he gradually builds meanings. He recognizes colors, shapes and forms, likenesses and differences. He perceives certain relationships. To ascribe to these objects or things a meaning is to perceive them. They mean something to him in terms of his previous experience and his "mind-set." In earlier years educators spoke of this process of interpreting experiences in terms of old experiences and the present mind-set as *apperception*.

Along with the child's growth in mental experiences, there is an improvement in the child's attention. He becomes able to pay attention longer, and to select the relevant from the irrelevant stimuli. He learns what to perceive as well as how to perceive it.

In comparison with the adult, children's perceptions are singularly lacking in form, definiteness, and detail. Many mistakes which children make in school can be traced to their inability to perceive accurately even the things of ordinary everyday life. As G. Stanley Hall writes: "There is next to nothing of pedagogical value, the knowledge of which is safe to assume at the outset of school life."¹

In the early stages of the formation of a percept, the child needs the stimulus presented in a definite way if the right response is to be secured. With the growth of experience, the percepts may be aroused with the minimum of the stimulus present. Reading furnishes a concrete example. In the early stages of learning to read it is necessary for the child to read every word in a paragraph in order to get the meaning, whereas the adult who is an experienced reader can get the meaning of the paragraph by skimming it hastily.

Adults and children are able to determine the content of their

¹ From an article first published in *Princeton Review*, Vol. II, pp. 249-272. Then reprinted in *Aspects of Child Life and Education*, Ginn & Co., 1907. Also see Hall's "Contents of Children's Minds upon Entering School," *Pedagogical Seminary* Vol. I, pp. 139-173.

percepts by their "mind-set," attitude of mind, or determining tendency. People tend to perceive what they want to perceive. Every bias, prejudice, or mood enters into one's perception. Children are influenced more than adults by every fleeting fancy, wish, or mental attitude. Doubtless this is owing to the fact that they can give attention for a short time only, and to their limited range of attention. The precept follows, that the aim of every lesson must be keenly appreciated by the pupils. Moreover, they must be given opportunity to "feel themselves into" the new work, to warm up to it.

Imagination Defined. Imagination is a mental process involving the formation of images. It is the awareness of sensory objects that are represented but not present to sense. Imagination does not give us new qualities of experience; it does not give us new connections. Imagination may be characterized by a feeling of strangeness, or the tendency to feel oneself into a situation (empathy). As we read of Lindbergh's flight to Paris, we picture the *aéroplane*, the land, the broad expanse of the sea, the crowd in Paris awaiting his arrival, the landing, etc. We feel ourselves into the situation. We become the hero. We glory in the work and suffer from the pangs of fatigue and hunger. The awareness of strangeness and empathy give us interest and satisfaction.

Types of Imagination. There are as many forms of imagination as senses, e.g. visual, auditory, etc. Imagination may also be considered as active, as in the case of one trying to design a new building or to map out an extensive educational program; or relatively passive, as in the case of daydreaming, reverie, and dreams. If considered from the standpoint of the product of imagination, it may be *reproductive* and *productive*. Memory is reproductive imagination. The representatives of former experiences are recalled and recognized with considerable faithfulness. Productive imagination implies that the combinations are new wholes although they depend upon old experiences.

Productive imagination includes: (1) the *free, spontaneous*, and more or less uncontrolled and passive imagination, as in the case of dreaming, fancy, and reverie; and (2) the more strictly *creative* or *constructive* imagination which is highly purposeful and controlled by experience and reflection.

The terms constructive and creative imagination denote some degree of originality, inventiveness, and creativeness. The term constructive imagination is the more appropriate if we wish to denote a small degree of originality and inventiveness. If a large degree is to be denoted, the term creative imagination expresses it better. All creative imagination is constructive, but not all constructive imagination is creative. Creative imagination refers to the most productive phases of constructive imagination.

Creative imagination is the source of invention, discovery, and all progress. It is basic to all that is fine and lasting in art, music, literature, and religion. It is needed in every type of vocation and profession. The value of creative imagination has been vividly set forth by Robert Witt:¹ "The possession of a vivid imagination, of the imaginative capacity in all its variety and many sidedness, is a gift of the gods themselves, and, as it were, priceless. Imagination has the power to alter the face of the world, to bridge distance, to annihilate time; like an alchemist, it can transmute, refine, transform; like the artist, it is skillful to glorify and to enrich. On the moral side of life it knows how to comfort and encourage, to inspire and control, to animate and to rejoice."

The imagination of the child is very vivid. In the best schools of today, the teachers are seizing upon every opportunity to develop constructive and creative imagination. Children are provided with appropriate sensory experiences. They are confronted with situations in the school that tend to utilize as fully as possible the child's originality and inventiveness. In the Lincoln School, for example, the children are omnivorous

¹ Robert Witt, *Westminster Review*, August, 1900.

readers. Their teachers develop in the pupils the want to express themselves. Some of the pupils write poetry, some write stories about industrial processes, and some paint pictures. Of course these activities are engaged in, in many other schools. In the Lincoln School the pupil is not required to express his originality according to some rule. Instead of following a copy slavishly, he puts himself into the production. In problem-project work, children have many opportunities to use productive imagination.

Imagery Types. Much has been written in the past about imagery types. Individuals were supposed to have some dominant type. People were classified into the eye-minded (visuals), the ear-minded (audiles), the motor-minded (motiles), etc. Psychological researches have led to the abandonment of this hypothesis. As a rule, the individual who possesses vivid visual imagery is also good in other kinds. Then it was found that an individual may employ one kind of imagery in the learning or recall of one form of material and another kind of imagery in learning or recalling some other form of material. Lastly, it was found that not infrequently an individual will use one sense avenue in learning, and another type of imagery in recalling what was learned. The results of the experimental studies indicate that it is unwise to attempt classification of pupils on this basis. "Instead of distinct types there is a continuous gradation. Instead of a few 'pure' types or many 'mixed' types, there is one type — mediocrity. Instead of antagonism between the development of imagery from one sense and that from other senses there is a close correlation."¹ It is advisable to make multiple sense appeals whenever that is possible.

Hallucination and Dreams. Hallucinations usually imply an abnormal condition or mental disorder. Objects are imagined as present to sense when no object, at least of the kind imagined, is being directly experienced. In hallucination, the

¹ Thorndike, *Educational Psychology*, p. 193.

objects are thought to be present by the subject. Such experiences may be due to some sort of internal irritation probably in the cortical area.

Dreams are a form of normal hallucinations. They are often bizarre and beyond our ordinary experiences. A stimulus present to sense or an emotional tension may serve to start a dream. The tonicity of the reaction system is probably the physical basis of dreams. Dreams are often incoherent because they are relatively free from the coördinating control of the cortical centers.

Imagination in Childhood and Youth. From the age of three or four years to seven or eight, the child's imagination is usually characterized as fantastic and spontaneous. Not infrequently the child manifests a disregard for the realistic. From about nine or ten to thirteen the imagination becomes more practical and purposeful. It is realistic rather than fanciful, objective rather than subjective. During the period of adolescence, from about thirteen to the early twenties, youth's imagination is influenced by an intense emotional life, characteristic of that period. The imagery now involves the youth's own motives, ambitions, and achievements. It is largely subjective and idealistic. Adolescence is a time for daydreaming and planning great things without regard to practical difficulties. Following adolescence, the imagination becomes less emotional and more practical.

Educational Warnings. In training the imagination of children, it is very necessary that children be not overstimulated. A certain type of motion pictures may develop the imagination of children to the detriment of both the child and society. The use of fairy stories like Cinderella, Red Riding Hood, Jack and the Bean Stalk, and Jack the Giant Killer is very questionable. They portray too much of robbery, murder, love, and marriage for young minds. It is true that many children do not suffer any unwholesome results from this exposure, but there is always the possibility of sensitive, "high-

strung," and nervous children being influenced adversely. Some of our best psychiatrists affirm that not infrequently certain nervous and mental disorders can be traced to some such story. The manner in which the story is taught or the attitude of the learner at the time is quite as important as the story itself. In view of the fact that there are so many wholesome stories available for the primary grades, there is no justification for using undesirable materials.

Educational Suggestions. By applying the principle of perception (apperception) to education it is obvious that the teacher's first task in taking up any new unit of instruction is to assist the pupils as economically and wisely as possible to get the proper information or attitude for the new work. This the teacher may do by stimulating the pupils to recall facts which will enable them to understand the new work by making them conscious of their need for further information and by introducing a specific aim which must appear worth while to the learner. Whenever children have not had the proper background of experience for understanding a new unit of instruction, the teacher should help them get the necessary experience. This may necessitate the reading of books, a trip to the zoo, the river, fields, or forests, the study of a map, or a careful review of what has been studied to date.

Better understanding of facts and principles can often be secured through the correlation of projects or other units of instruction in the several subjects.

Illusions. The power of the human mind to read into situations something other than what is literally sense may be clearly illustrated in the case of illusions. The actual image we get of a rectangular table top is quite different from the way we actually perceive it. We perceive it as rectangular, although the image we get is one with acute and obtuse angles. The image is corrected automatically, in most instances, owing to our background of experience. We get an inverted image of the man walking along the street, but we perceive him as walking erectly.

Psychologists have made numerous studies of the accuracy of human powers of observation. The method which is commonly used is referred to as *fidelity of report*. A picture or some scene is exposed for a brief period and a verbal or written report is called for immediately. The length of exposure depends on the complexity of the picture and the maturity of the subjects who are being tested.

Experimentation has shown a surprising lack of the ability to reproduce what has been experienced. A large percentage of the persons who have been tested are unable to tell whether four o'clock is designated on their watches by IV or IIII. A dozen young children will give a dozen reports concerning an accident which happened on the playground. Whether anything can be accomplished in sense-training is a disputed question. Opportunity can be given, however, which will enable the student to have more and richer experiences. Training is not so much the use of senses as it is of attention and methods of observation. The type of observation used is dependent upon the aim. Some stimulus may be forced upon us, and we attend to it because we cannot escape it.

Conclusions, however, drawn from experimentation should be weighed for validity. It is often assumed that a child has actually experienced through observation. He may in the direction of a watch see that it is four o'clock without having even looked at the figures on the watch face, or seen them; he has felt no need for seeing them. Experience is derived through activity in attempting to overcome a difficulty or to attain an end. Little or no experience results from the study of conventional subjects like geography, history, spelling, or arithmetic. These subjects provide for the organization of experiences, and the application of observations made outside of school.

According to the popular conception, imagination refers to bizarre, unreal, and untrue experiences of the mental life. The correct connotation of the word can be made clearer if we contrast imagination with memory. Imagination is a broader

term since it includes memory. Consequently, we must contrast reproductive imagination (memory) with productive imagination. It is obvious that reproductive and productive imagination activities overlap since they exist together in integrated patterns comprising the whole. Memory or reproductive imagination involves the representation of previous sensory experience. It denotes a reinstatement of cortical processes that were previously active, together with the awareness that the conscious facts were previously experienced. What the memory leaves out of the picture is filled in by the productive imagination. While memory always refers to the past, imaginary experiences may refer to the past, present, or future. Memory processes must necessarily be true whereas imagination processes may be true or false. Thus imagination may refer to the reproduction of images of sensory objects or things not present to sense or it may denote a new combination of experiences, based however upon sensory experiences of the past. A child born blind would be unable to image the colors of the spectrum. Not having seen them, he could not imagine them.

Objects of memory and imagination are not always distinguished correctly. Neither are sensory experiences always perceived correctly, as we saw in the case of illusions. Individuals may claim that they recall events which actually never occurred or they may assert, as imaginary, certain events which they really experienced.

Questions and Problems

1. What is a percept? Distinguish between a percept and a sensation.
2. Comment on the statement that the only way a teacher can influence her pupils is through the employment of physical means, for example, voice and personality.
3. Contrast the perceptual life of the infant with the perceptual life of the adult.
4. What is "mind-set"?

5. How may the teacher utilize her knowledge of perception in making the lesson assignment? in introducing a new subject?
6. What are the educational applications of perception?
7. How does the attitude of the learner influence perception?
8. Distinguish between perception and illusion. Make a list of illusions which are common in daily life.
9. How does mind-set influence perception?
10. What is a delusion? How do you account for delusions?
11. Stories have been told of Indians recognizing smoke or of detecting an animal at much greater distance than was possible for the average white man. How do you account for this seemingly superior vision of the Indian?
12. Should all the senses be trained? If so, how?
13. Define imagination.
14. Distinguish between imagination and memory.
15. What are the types of imagination?
16. How should young children be trained to distinguish between fact and fancy?
17. State clearly the difference between productive and reproductive imagination.
18. Should subject matter be presented solely through one sense? Why or why not?
19. What are hallucinations and dreams?
20. Distinguish between the following: memory, perception, imagery, hallucination, and dreams.
21. What are the characteristics of the imagination of the child at the various levels of his development? In what respects does the imagination of the child and that of the adult differ?
22. Of what value is the imagination? What suggestions would you give for training the imagination?
23. Of what value is dramatization?
24. Productive imagination is commonly divided into constructive and creative imagination. Distinguish between constructive and creative imagination.
25. Make a summary of all the helpful suggestions on imagination that are contained in this chapter.

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Edward Bradford Titchener

CHAPTER XII

MEMORY

LONG ago it was believed by many individuals that memory was a faculty located in a certain convolution or lobe of the brain, and that this power or faculty could be improved through exercise. Subsequent studies have proved conclusively that memory is not a faculty. It is a function of cortical brain cells that operate in integrated patterns. While there is a grain of truth in the assertion that exercise improves the memory function, much more than exercise is required in the development of a serviceable memory.

Memory Defined. Memory has been defined as the reinstatement of old experiences together with the knowledge that they have been experienced previously. It is recall with recognition. It is a knowledge of a former state of mind, of which we have not been thinking in the meantime, with the additional awareness that we have experienced or thought of it before.

Memory is not a photographic reproduction. An individual, recollecting scenes of his childhood, knows that they are far from being exact. He does not get a complete picture of the scenes. Many of the visages that are reproduced are much distorted. It is for this reason that one individual is often mistaken for another.

Memory involves four fairly distinct processes: (1) learning or registration; (2) retention; (3) recall; and (4) recognition. These four phases of memory are not always easily distinguished. A comprehension of memory depends upon an understanding of the four phases.

Every impression obtained changes the organism in some

way. The modification is retained permanently. Some impressions may be so weak that they do not give rise to memories or habit. In the broader meaning of the term, memory is not limited to words and ideas. The individual must learn, retain, and reproduce all forms of learning. Habits, in this sense, are unconscious memories. Perception, imagination, and reflective thinking all depend upon memory.

The individual's memory is not equally developed for all kinds of objects and ideas. An individual may have a good memory for names but not for musical terms. These observations have led psychologists to use the term *memories* rather than *memory*.

Some psychologists believe that it is unscientific to treat of memory as a mental fact.¹ They interpret memories as retention of habits. When a fact is remembered, that which is retained is the tendency to whisper or speak out loud the appropriate words whenever the proper stimuli connected with these sounds arouse the cortical cells. By memory, they mean nothing but the fact that when the subject meets the stimulus again after an absence, he does the old habitual thing (says the old words and shows the old visceral-emotional behavior) that he learned to do when he was in the presence of that stimulus in the first situation.

Retention. Retentiveness is dependent upon the structure and organization of the nervous system. The degree of retentiveness is conditioned by the individual's plasticity. The only control we have over retentiveness is of an indirect sort. Through learning in the most economical manner and by frequent recall of the materials learned, better results will be secured. The original capacity to retain remains the same. The increased efficiency is due to its wise use.

Retention is probably owing to a structural or functional modification in the nervous system. The repetition of an act leaves certain effects upon the structures involved so that they

¹ This is the view of the radical behaviorists.

will respond more quickly and easily in a similar situation. The revival of former reactions and attitudes gives meaning to objects and their representatives; and we react to objects or symbols in accordance with the meaning. No mental act or experience is retained as such. The activity leaves a deposit or mental changes that persist and modify subsequent reactions.

Recall. Recall is the ability to reinstate that which has been retained. This ability depends very largely upon the manner in which the material was learned. If the individual forms logical connections or associations between the material learned and the situations which make its recall desirable, recall is greatly facilitated. The ability to recall can be improved if the learner masters each new fact in connection with many or all of the possible situations that may require its application. The laws of recall are fundamentally the laws of association.

Recall also depends upon the attitude of the learner toward the situation present. This fact may be illustrated by the failure of the teacher's question to elicit the proper responses in the pupil when he knows the answer to the question. The question, as asked, failed to give the proper cue for the answer. Very frequently the pupil thinks of a question in one way and the teacher in another. The result is that the pupil does not answer to the teacher's satisfaction. It is obvious that good questions or directions must give a cue to the answer.

Recognition. Recognition follows recall. It involves an "awareness of the time and place of origin of the memory image."¹ Recognition implies that images and ideas recalled arouse in us a feeling of pleasurable familiarity. The object presented arouses associates in experience which give evidence of their presence by the object being recognized. The stimulus that excites the response probably elicits a number of familiar reflex movements which aid in the recognition. Occasionally an individual has an illusion of recognition. One may feel,

¹ Pillsbury, *Essentials of Psychology*, p. 227.

when visiting in a strange city for the first time, that he has seen it before. The various buildings may seem strangely familiar. This illusion, which is called *paramnesia*, is explained on the ground of certain elements in the new situation being similar to elements in old situations. The similar elements arouse associated patterns which give the feeling of familiarity which pervades the entire situation.

Forgetting.¹ Forgetting denotes that the learner is unable to remember previous experiences at the time that he wishes to recall them. Forgetting varies in degree from the inability to recall a name to *amnesia* or total loss of memory. Forgetting may be temporary or permanent. It may be the result of defective retention caused by the beginning of senility, disease, drugs, nervous shock, or other conditions. Not infrequently it is caused by sheer inability to recall owing to a lack of associative connections with the present situation. Sometimes, after associations are formed, they may become disassociated. Material may also be forgotten owing to its repression by more recent acquisitions. The wrong response is elicited instead of the one desired. For example, if X were originally associated with Y, and later became more strongly associated with Z, X is more likely to elicit the response Z than the response Y. The tendency is to forget the X-Y association.

Memory Images. Memory depends upon the revival of images, ideas, or concepts of past experience. Some of the images carry a feeling of familiarity. Others may appear without giving us any feeling of familiarity. An artist sees "in his mind's eye" a group of figures which he believes to be original with him. He may not remember having perceived or imaged any similar combinations before. Yet it is quite possible that he has either seen such a scene before or heard the arrangement proposed. He had retained the image but forgotten the old associations. Such instances of involuntary and unconscious plagiarism are not uncommon.

¹ See "Forgetting" in Chap. VIII.

Children may confuse the fanciful with the real. Their falsehoods are not lies in the ethical sense of the term. They are products of an uncontrolled imagination due to the lack of proper standards for distinguishing the real from the fancied.

Individual Differences.¹ Children's memories differ in certain respects from adults'. Great variations also exist among both children and adults. Some pupils learn readily and retain well. Some learn quickly but forget rapidly. Others learn slowly and retain tenaciously, and still others learn slowly and forget rapidly. There are pupils who learn rapidly in some subjects and slowly in other subjects. There are all degrees of differences in the ability to remember names, faces, words, sounds, colors, and rhythms. Some individuals retain well for short periods of time. Others retain for longer periods. Some remember better if the impressions are gotten through the visual sense avenue, while others learn better if the impressions are gotten through another sense. Some of the differences in memory abilities are due to heredity. Other differences are due to interest, purpose, health, and education.

Testimony. In many cases testimony or reports are made long after the events happened. The reliability of such testimony varies with individuals. Its fidelity depends upon the accuracy of the observation at the time of the event, ability to retain, and ability to recall or remember, not only the major outline, but also the minor details. The longer the interval between the happening or event and the recording of testimony the more inaccurate it becomes. Whenever several witnesses give identical testimony it indicates that all have agreed upon a set report. Good testimony from several witnesses varies in certain respects. The teacher should make application of these facts to classroom situations.

Faulty Memory. In addition to normal inaccuracies in memory, certain disorders are not uncommon. *Amnesia* is a loss of memory. It exists in varying degrees but is seldom a

¹ Discussed in more detail in Chap. VI.

complete forgetfulness. Amnesia is generally a forgetfulness probably due to a brain lesion or nervous shock. It may last for a few moments or continue for years.

Cramming. Cramming is a process of learning rapidly by repetition. It is effective for remembering for a short time only, because no associations or relations are set up in the mind. Knowledge learned by cramming may be recalled after a relatively short time, but, as a rule, it cannot be recalled after a long interval. The learner long remembers the lessons which are discussed, thought out, and associated with other information or experience.

If the learner masters a lesson by cramming, he should frequently review it subsequently in order to keep it alive in his memory. Cramming is not a substitute for faithful daily work because insufficient time is taken to associate the facts with each other or with something already known to the learner. A good way to study is to go over the entire material to be mastered. If the facts have no logical connections, some arbitrary associations may be formed to help the learner remember.

Cramming for examinations is good and bad, depending upon how it is used. If in a strenuous review the learner refreshes his memory and notes the interrelations of topics and the main ideas, cramming has much in its favor. If on the other hand cramming is a feverish last minute effort to memorize masses of material which should have been learned during the course, it is decidedly bad practice. This last minute cramming gives only a confused smattering of the subject.

Cramming is often a necessary procedure in adult life. A lawyer may find it necessary on the night preceding a trial to memorize certain statutes. He wants to use this particular information for one day and may then forget it. A speaker wishing to quote statistics, memorizes them for the occasion, only to forget them after his speech has been delivered. After such material has served its purpose it may be sufficient to know where the information can be found should future occasion require its use.

A Serviceable Memory. A good memory is one that permits the forgetting of irrelevant and unimportant material. Mental distraction or a nervous breakdown would result if one remembered everything learned.

A good memory is a serviceable memory. A serviceable memory is one that: (1) enables the individual to remember readily relevant facts which are free from useless and distracting material; (2) insures accuracy of recall; (3) retains for a long period of time if necessary; and (4) recalls and recognizes facts promptly and easily.

Improving the Memory. While it is impossible to change an individual's ability to retain impressions, it is possible to develop a memory that is serviceable. The problem of improving the memory involves the employment of economical methods of learning. The formation of logical associations, and the practice of recall, together with perseverance and industry are valuable helps.

Every normal individual can make the memory more serviceable. The methods by which this can be accomplished are all common sense methods. We do not need to resort to highly complex, artificial, and fantastic aids.

Every experience in life leaves a trace in some nerve centers. Some of these impressions fade away almost immediately, others persist a little longer, while still others remain throughout life. There are certain reasons why some persist longer than others. If we wish to remember easily what we have experienced, it is necessary to know how to make impressions indelible. We must know how to form the proper associations, and what rules of recall and recognition to observe.

The first rule is to make sure of obtaining a clear first impression. This may be done by bringing to bear as many senses as possible on the object or idea to be remembered. The impressions obtained from the sense of sight are recorded on entirely different sets of cells from the impressions transmitted through the sense of hearing, or any other sense. All cells and

all sets of cells are connected, however, so that the more impressions the learner gets, other things equal, the more associations he will possess with which to bring them into focus of attention at will. Memory for names and faces may be improved through exercise. This process is facilitated if the learner makes sure that he knows the name exactly, notes how it is spelled, addresses the person by name, looks the person in the face, and notes the features of the face and any expressions or mannerisms. By the time the conversation is ended, the learner will have a clear mental impression of both the name and the face of the individual.

Repetition fixes in memory the reactions made to a situation. It is necessary for every learner who is bent upon mastering any selection, to repeat it over and over until it becomes second nature. The intent to remember tends to fix the impression and reduces the number of repetitions required for its mastery. An interesting story is told of a foreign student who was studying in one of the universities of Switzerland. He was in the act of learning by repetition a series of nonsense material. His instructor, noticing he was apparently having difficulty, remarked that he was taking a long time to learn the material. The student's reply was that he had not understood that he was to memorize them. This makes clear the fact that it is attentive repetition that counts. To intend to remember, is to attend. Inattention is probably the most common of all abuses to which students subject their learning process. They do not focus sharply and clearly on one thing at a time.

Repetition of recall is more important than repeating the impression. The initial impression should be trusted. It should be held until it is fixed by some bond of association; then, instead of the impression being repeated, the attempt should be made to recall, and then to repeat the recall as often as may be necessary. One recall is worth many impressions because it is the recall and not the impression that is to be fixed. When practicing recall, the learner should be rigidly exact.

When recalling, the irrelevant should be excluded by concentration upon the problem in hand.

The formation of proper associations facilitates recall. One rule is to observe the relations of the impression. Facts are more easily recalled when they are arranged in a system of relations. Dr. Link tells of meeting a man by the name of White who said that he lived at 25 Saint Nicholas Avenue in a certain city. Link's mental memorandum was as follows: "White — White Christmas; Christmas — the 25th of December — St. Nicholas." In this way, there was little chance of Link's forgetting that Mr. White lived at 25 Saint Nicholas Avenue in New York City.

The more simple the associations are, the less of a burden they become. Natural and simple associations are useful, but highly artificial and fantastic devices are a special and temporary utility at best. Memory-training systems usually involve the use of various mental gymnastics, the use of illogical and unnatural associations, and the learning of useless material in order to remember that which is desired. The mnemonic doggerel may be remembered when the material it was meant to recall has been forgotten.

Professor Titchener and many other psychologists agree that, "*No scheme of memory-aids that is universally applicable and universally reliable has been or can be discovered*; there is no royal road to learning. In so far as a mnemonic rule follows the *laws of associative tendency*, as for many minds the local or topographical rule seems to do; or in so far as it chimes with some peculiarity of individual thinking: in so far, it will be of practical service in daily life; that is the most that can be said."¹ Memory is not an organ that is strengthened by exercise; it is a function that becomes more serviceable through use that is satisfying.

Interest is an important factor in memory. Students seldom experience difficulty in remembering the names and faces of in-

¹ Titchener, *A Beginner's Psychology*, pp. 193-194.

dividuals who can be useful to them in a social or business way. The mind that is not kindled with interest and enthusiasm accomplishes but little. The student learns and remembers better the subjects which are of genuine and vital interest to him. Comprehension, likewise, makes remembering easier. A selection is more than half memorized when the pupil understands it. Understanding involves the comprehension of logical relations between all the given facts, which are the major and which the subordinate principles, and the bearing each has on all of the others. That which is focalized in consciousness, comprehended, and woven into the warp and woof of one's experiences through numerous associations is retained both easily and indefinitely.

Every individual should train himself to remember facts pertaining to his work and life interests. No one can learn and remember everything, therefore the individual should make a careful and thoughtful selection of the things that it is necessary to remember in a social environment, and concentrate on these.

Summary of Rules for Economical Memorization. Memorizing to the average student is a task to be accomplished by any means so long as it satisfies his purpose. One seldom stops to realize that there are different aspects of memorizing and that it is to one's advantage to use those aspects which are most economical.

First of all the student should give some attention to the place in which he intends to work. The room should be easily adapted to favorable conditions of light, temperature, and ventilation. The possibilities of interruption and distraction should be reduced to a minimum.

The importance of a right attitude toward the work cannot be overemphasized. If the task is a pleasurable one, the contribution to economy and efficiency by such a state of mind is by no means a negligible one. It both fixes the bonds and motivates the activity.

In addition to the importance of a right attitude toward the task, there must be considered the student's own condition of mind and body. When mentally and physically fatigued, the pupil can scarcely hope to accomplish much at memorizing. Mental alertness is at a premium.

In general there are two types of material required for memorization, logical and mechanical. In attempting to memorize material of the latter type, it is necessary to examine it carefully to discover any possible associations of events or thoughts, and all possible connections of time and place. Then the parts that appear to be most difficult and important might be set aside to be studied first, and later linked with the whole.

The next step is to decide which method is best, as judged by previous circumstances. Some students are fortunate enough to require only one means of approach, but for the majority many different ways, or what is termed the "multiple sense appeal," is better, that is, seeing it, saying it, hearing it, and writing it. In this way the original impression is augmented by appeal to many senses and the recall will be just that much easier.

Sometimes students make use of mechanical devices, such as making connections between the colors of the spectrum and the word "vibgyor." This is sometimes legitimate and makes for economical memorizing, providing the cue is not forgotten. To prevent this, one should use his own system of mnemonics rather than a borrowed one.

The importance of overlearning cannot be emphasized too much in mechanical learning. The very fact that the information is more or less disconnected will lead to its being quickly forgotten unless overlearned at the beginning with frequent reviews.

The field of mechanical memorizing is clearly limited. The method which all students should use in learning school subjects is the logical or judicious method, because material acquired this way is remembered for a longer time after associations have

been formed and relationships perceived or understood. Here again the multiple sense appeal is used. Certain practical suggestions may be offered. Repeating aloud the difficult passage in the lesson, and writing the topics, facts, or difficult words, are helpful. Asking oneself the questions and outlining the lesson in writing helps to summarize the material. If the main points in the lesson are recited today, the chances of reciting them the next day are much more favorable. Successful recitation, outlining, and testing are stimulating and satisfying, and lead on to further effort.

For the majority, repetition is necessary to strengthen the impression. It has been proved that it is better to distribute these repetitions over a period of time. A rest between repetitions serves to fix the impressions more firmly and more is remembered for a longer time. Since we forget rapidly at first, and then more slowly, it is well to have the earlier repetitions more frequent. As learning progresses, the intervals between repetitions should be gradually lengthened.

Experiments have proved, in some instances at least, that it is more economical to learn a selection as a whole instead of in parts. If the selection is so long as to demand part-learning, care must be taken to insure a logical relationship between the parts. When the whole method is used, the material is memorized as it is to be reproduced and no extra associations need be made between parts.

The advantages of the whole method may well be applied to any school subject, as it brings about the associations of the main facts. The recall of one or more of the associated ideas will bring to mind other related facts and the whole lesson will be clearer.

Of course, the extent to which one learns depends largely upon the purpose or end which he has in view. If he is preparing for a future calling he will want to learn permanently and in such a way as to facilitate the retention and use of the facts he is studying.

Ideas and facts recalled from past experiences vary in clearness and reliability. They cannot always be trusted. The influence of imagination often causes changes in our recollection of past experiences when they are brought to bear on present problems. It is therefore always well to scrutinize the recollections of past experiences before we attempt to use them.

In general, a student must have confidence in his ability to recall. If one recollection is distrusted, others recalled in turn will be doubted also. This leads to confusion and plays havoc with confidence in one's own ability. If the learner has studied effectively, his ability to retain may be trusted.

Questions and Problems

1. Define memory.
2. Distinguish between memory and imagination; between recall and recognition; between paramnesia and amnesia.
3. A fifth-grade pupil complains of a poor memory. The pupil's work in school is of such character as to give support to the view expressed. What should be done for the child?
4. Account for individual differences in the memory function.
5. What is cramming? Is it ever justifiable? What laws or principles of learning are violated by the student who uses the cramming method?
6. What are the characteristics of a serviceable memory?
7. Can the memory function be improved? Explain fully.
8. What is a mnemonic device? Is an individual ever justified in using such "crutches"? Why?
9. Make a list of rules for economical memorizing. Discuss them with some friend. Do you agree regarding the value of each rule?
10. What are the advantages and the disadvantages of the "part-method" of learning? the "whole-method" of learning? What are some of the factors that determine the efficiency of any method?
11. Make a list of the suggestions that you would give a pupil who wishes to memorize a selection, for example, "Thanatopsis," or Webster's "Bunker Hill Address."
12. Might some very stupid people have excellent memories for names, faces, or dates? Account for the fact.

13. Do you think there is any value in memorizing apart from the social value of the thing memorized? Why or why not? Test your answer by reading the Chapter on "Transfer of Training."

14. In what sense is memory fundamental to imagination? to thinking? to willing?

15. Suppose a teacher does not remember names and faces readily. What suggestions would you offer her for making her memory more serviceable in these respects?

16. How is the teacher to know what things are to be memorized verbatim?

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CHAPTER XIII

ATTENTION AND INTEREST

ATTENTION and interest are mental processes that are interrelated. Attention is basic to interest and interest causes attention.

The individual's awareness is limited. Out of the great mass of stimuli assailing him through many of his senses, he selects certain ones that come within the focus of consciousness. He is either dimly conscious of the other stimuli or not aware of them at all. Out of a large number of objects presented to a child at one time, he notices a few. Then there are many things in the world about him that he would never notice unless his attention was called to them. As the student is reading this paragraph, his attention is directed to its content. He may be ignoring the conversation about him and the schoolboys in the street. He may be unaware of the passing of automobiles and carriages. He may be unaware of his plans for tomorrow, or even the pressure of the clothes on the body or the excessive temperature. In fact, everything is more or less removed from the focus of consciousness except the matter under consideration. It alone stands out clearly and vividly, much as a mountain stands out in bold relief in contrast to the valleys below.

Definition of Attention. Attention, according to Pillsbury, is "synonymous with selection of what we shall notice."¹ There are certain fairly well defined laws that control this selection and from these it is possible to draw certain educational suggestions.

The aim of every attention process is to enable the individual

¹ Pillsbury, *Education As the Psychologist Sees It*, p. 107.

to make a better adjustment. Attention helps him to get a stronger grasp on the situation. It enables him to get more detail, greater clearness, and better understanding of that which he perceives. When the object of attention is some idea or concept, attention enables the individual to grasp more of the whole setting and the relationship involved. In the case of recollection, attention makes it possible for the individual to trace out the details in time and place.

It is obvious that attention is dynamic in character. It enables us to view the present, to reach back into the past, and to go beyond that which we have at the moment. It makes possible a mental life which is integrated and harmonious in character.

The inner activity involved in the process of attention may be entirely spontaneous, owing to inner urges and drives, or it may be induced by the application of a suitable stimulus from without. In the first case, children may be observed to give attention instinctively. Attention to a clap of thunder is an illustration of the second case.

Kinds of Attention. The processes of attention have been classified as voluntary, nonvoluntary, and involuntary. The attentive process is voluntary when it is attended with a sense of effort and conditioned by duty, purpose, or social pressure. The student, for example, must prepare his lessons in psychology for tomorrow. He sits down to make the preparation. After reading a few lines, he hears several of his comrades outside of the dormitory window. They are talking about the next football game. Almost decided to join them, our student recalls that his instructor expects everyone to be prepared to discuss the assignment. He realizes how embarrassing it might be for him if he did not make the preparation. Consequently, in less time than it takes to tell it, he has concentrated his attention on the task at hand. Focusing attention first upon the unit as a whole, then upon the different details in succession, and again upon the relations of the parts to the whole, he "ground" out

his lesson. The more he got into it, the more clearly he perceived and understood the relationships involved, the more he became interested in the subject. He no longer experienced a consciousness of effort in his study. He read more and more, not because of duty or social pressure, but because he was interested in the subject. His attention had been gradually transformed from the voluntary into the nonvoluntary. Here the conditioning factor is the mental attitude at the moment, purpose, interest, etc. These conditions constitute, in brief, the conditions of desire. The satisfyingness is primarily derived from the mere act of attending, rather than from the nature of the thing attended to. The individual's mental-set rather than the nature of the stimulus is of primary importance. The major business of education involves the development of nonvoluntary attention out of the voluntary. One form of nonvoluntary attention is characterized by its spontaneity. This is owing to the fact that some activities are natively interesting and satisfying. The child gives attention easier to these activities than to others.

Involuntary attention is determined altogether by objective factors, such as strength of the stimulus, change in position of the stimulus, etc. In any event, the stimulus is strong enough to force itself into the focus of consciousness regardless of all other conditions that obtain at the moment. There is little of educational import concerning this form of attention, except that as many distractions should be ruled out as possible.

While three forms of attention have been mentioned, they are by no means entirely distinct. They produce much the same effect in consciousness, although the complexity of the reaction patterns vary considerably.

In the discussion pertaining to voluntary attention it was pointed out that the process is attended by a sense of effort. The individual is aware of the energy expended or the efforts put forth. In the case of nonvoluntary attention, which is conditioned by interest and satisfyingness, the individual ex-

erts greater effort than when attending voluntarily, but this time, he is not aware or only vaguely aware of the expenditure of energy. In the one case, the sensations attending the expenditure of energy become focal; in the other, they are the marginal elements or fringe of consciousness.

Whenever we direct our attention to any object or idea, that object or idea, and the relationships involved, probably become both clearer and more vivid. This is owing to the change in human impressiveness, rather than to any change in the stimulus. Ideas and objects on the margin or fringe of consciousness tend to lose their impressiveness and to fade away.

Motor Concomitants of Attention. An interesting motor accompaniment of attention may be observed. As soon as we have attended to some object in our surroundings, we are literally ready to act in response to it. All our movements and adjustments become related to that object or idea. We tend naturally to fixate the object or idea attended to, and to make the necessary adjustments of sense organs, muscles, and the whole body condition so as to secure the strongest impression. Even breathing, bodily posture, and the activity of the internal organs are involved in this process of adjustment. The neglected and inhibited impressions are no longer starting points of action; only that to which we attend becomes the starting point of action.

Getting Attention. Attention is controlled to a large extent by mind-set and training. The individual's experiences at any moment are in part conditioned by his attitudes or mind-set. Objective conditions also attract the attention, as we saw in the case of involuntary attention. The familiar and usual has less power to excite our attention than the strange or the new, but the familiar in a strange setting attracts attention very quickly. An individual readily recognizes the face of a friend in a crowd of strangers. The individual is in a state of readiness to recognize this friend because of the past experiences. Newness, glaring and loud impressions, the con-

trast of stimulus with other stimuli, the ease with which impressions may be apprehended, the absence of counter attractions, etc., secure attention to a given situation.

The teacher may get the attention of pupils by making an appeal to their personal experiences, native interests, desires, and personal biases. Attention may be held by the same means. If a talk or discussion can be so directed that it will arouse a large number of associations, the attention of the auditors will not lag.

It is comparatively easy to attract the attention of pupils, but not so easy to hold it to the activities or to get it to lead to the desired action. The child gives attention as long as he is able to inhibit the impulses that would distract it. However, the experiences that are marginal one moment may be focal the next, and that which was focal becomes marginal. The obvious result is the fluctuation of attention. It is impossible to attend to everything for a long time. Fatigue interferes and causes the focal idea, percept, or purpose to grow dim, and the experiences that have been on the fringe of consciousness rush into the focus.

Concentration of Attention. Probably all learners experience some difficulty in the concentration of attention, that is, they experience difficulty in attending to that which they try. The feeble-minded cannot concentrate their attention for any length of time. Some individuals, like Einstein and Edison, are able to give close attention to a closely related unit or group of ideas for a relatively long period of time. Of course their attention fluctuates from one item to another within the configuration, but they are able to bring the attention back immediately to the major problem under consideration. The ability to concentrate is in normal individuals highly correlated with intelligence and training.

To pay attention consists in keeping the desired object at the center of the conscious process and keeping the distractions in the background. The first step in learning to concentrate con-

sists in devising ways and means of overcoming the distractions. If we apply this principle to study it means that we must find a place and time for study where physical conditions will be most suitable for study, and the distractions reduced to a minimum. When distractions occur, as they inevitably will, let the student bring himself back to the task with a determined effort to ignore all distractions. Then he should ignore them. By doing this promptly and repeatedly for some time and allowing no exceptions to it, the individual will soon develop the habit of concentration. Since individuals pay attention to that which interests them most, it follows that much attention should be given by the teacher to the development in her pupils of suitable and abiding interests.

When distractions are due to vagueness of the material being studied, the learner should make greater effort to understand what is being studied. It may mean strengthening his vocabulary, or getting an adequate background of experiences or knowledge. The ability to concentrate presupposes a firm foundation on which to build. Finally, allowing the object of attention to lead to action also facilitates keeping the object in the focus of attention. From this discussion, it is obvious that attention is an active dynamic process, and that the ability to concentrate means ability in all of the mental processes. Economical learning implies that the pupil must give clear and undivided attention to the essentials of instruction, with limited or fleeting attention to nonessentials.

It is patent to every teacher that children can "pay attention" for a very short period of time. Their attention is given in a series of pulses. Consciousness is like a stream. It is one thing after another that is focal. Attention in the adult is similar to that of the child in that attention is first to this and then that, although the adult gives attention for longer periods of time, and keeps to the subject longer.

The teacher can get the attention of pupils better, other things being equal, if the stimulus presented is vivid and clear

cut. The contrast of one stimulus with other stimuli facilitates attention, other things being equal. The amount and degree of attention depends upon the clearness of the impression, i.e. the ease with which it may be apprehended. Finally, it is highly desirable that not too many objects or facts be presented at one time. Counter attractions tend to inhibit attention. The child needs to assimilate that which he attends to.

Interest. The learner does well at things which interest him and very badly at things which arouse no interest. One of the major tasks of every pupil is how best to develop an interest in activities which are not originally interesting. As it was pointed out above, we attend to some things and tend to ignore others. As William James writes: "Millions of items of the outward order are present to my senses which never properly enter into my experiences. Why? Because they have no *interest* for me. *My experience is what I agree to attend to.* Only those items which I *notice* shape my mind. Without selective interest, experience is in utter chaos. Interest alone gives accent and emphasis, light and shade, background and foreground — intelligible perspective, in a word. It varies in every creature, but without it the consciousness of every creature would be a gray chaotic indiscriminateness, impossible for us even to conceive."¹

Definition of Interest. Interest may be defined as that attitude of mind "toward a course of action or an object in which one is impelled from within to carry on the action, or to give attention to, examine, handle, approach, or in other ways act toward the object; and in which the satisfaction of this impulse gives pleasure."² Psychologically, it is mind-set. It is whole-hearted endeavor.

Native and Acquired Interests. Some situations appeal to special instinctive trends from the beginning; others fail to do so until the proper connections have been organized in the

¹ James, *Principles of Psychology*.

² Freeman, *How Children Learn*, p. 64.

course of individual experience. The former set of activities are originally interesting in themselves; the latter are natively uninteresting and interest in them must be developed. Whether it is feasible to develop an interest in any particular activity depends first of all on the unlearned equipment of the person, for activities can artificially become interesting only through first becoming associated with some natively interesting activity. This natively interesting activity may be owing to some special ability, such as a talent for music, mathematics, or drawing; or to some activity which involves such satisfactions as inventiveness, manipulation, social approval, and the like.

If we examine the native interests of children, we will find they lie altogether in the sphere of sensation. Children are interested in *novel sounds, sights, odors, tastes, and the like*. This is particularly true when action and movement are involved. It is for this reason that moving pictures make such an appeal to people of all ages. *Living and moving things*, and things that have a *dramatic quality* are instinctively interesting to childhood.

The acquisition of later interests presupposes enough intelligence or general ability for the activities involved to lead to further activities of a satisfying nature. Interest begets interest. Interests may be imitated, owing to some dominant ability or combination of native abilities. It is also important, however, that there exist a possibility of continued satisfaction from the exercise of the activity. It has been observed frequently that on the whole an interest is not permanently gripping unless it continually faces some element of conflict, novelty, or difficulty.

Developing Interest. What procedure should be followed in developing many-sided, abiding interests? How are we to "tie up" the acquired interests with the earlier instinctive interests? Professor James writes as follows on this subject: "Any object not interesting in itself may become interesting through becoming associated with an object in which an interest already exists. The two associated objects grow, as it were, together;

the interesting portion sheds its quality over the whole; and thus things not interesting in their own right borrow an interest which becomes as real and as strong as that of any natively interesting thing."

James's statements may be made clearer by citing two concrete examples. The pupil who dislikes biology will invariably develop a gripping interest in the subject if it can be related to the health, wealth, and happiness of the community. The student of physics may find the subject a grind, but if it is introduced by allowing the pupils to build radio sets, repair automobile motors, etc., a new interest is aroused. From these illustrations it is obvious that one activity may influence another with its own emotional tone when the two have been associated together. In fact there is no limit to the various associations into which an interesting idea or activity may enter. In just so many ways may a new interest be *derived*.

From these facts it is possible to formulate some good rules of procedure for the teacher to follow. It is necessary to start with the native interests and then associate with them the activities with which they have some immediate connections. Then, as the teacher continues at this task, the later experiences and ideas are to be associated with the first. The new is to be associated with the old in some natural and effective way, until interest pervades the entire subject. In developing the desired interest, the teacher must utilize the laws of effect and exercise. She must get vigorous action along the desired line, and this action must be satisfying. She must get the activity going with zest. If she can do this in the face of difficulties and obstacles, so much the better, for nothing is more interesting than overcoming difficulties that call for all but the last reserves of energy. If the difficulties keep up, the learner must be sustained by some purpose, or belief that the end is worthy of the effort. The approval of others, especially the approval of those for whom the learner has considerable trust and confidence, will often stimulate his faith in the goal to be realized.

Other Educational Suggestions. In developing interests in pupils, the teacher must set up situations that will admit of success and satisfaction. To meet with success is to arouse in the learner an inner urge or drive which carries him forward. If he is interested, the dominating activity furnishes the drive. If he puts every ounce of his energy into his work for some worth-while end, especially for a difficult end, and if he realizes that he is succeeding, if he hears the plaudits of those whose praise he values, then he has a vital interest in the work and in being approved. He should also know that the same interest will develop so that it will furnish its own motive power even without plaudits, and perhaps even amid jeers and without the present signs of success. The varied efforts in the real battle to achieve the goal that is called for by the interest suffices. The interest of men like Darwin, G. Stanley Hall, Millikan, Wundt, Mayo, and Dewey became a *source of effort* and the effort aroused additional interest.

If teachers develop interests in honesty, sincerity, consideration of others, fair play, fair-mindedness, and the other virtues, the procedure is much the same, at least, insofar as the virtues are interests. If teachers wish to build an interest in psychology, the procedure, in way of review, would be: (1) to tie up the interest in the making, with some native tendency of the learner; (2) to stimulate the learner to attack the subject with zeal; and (3) to guide him in connecting up the new subject with his life experiences. Then let the student read everything he can get on the subject, especially authors like James, Hall, Angell, Overstreet, Kitson, and Dorsey. Let him talk it over with others, and write in his letters about this wonderful science of human behavior that helps to understand, control, and predict behavior with ever-increasing accuracy. In the course of talking over many of these ideas, that which was hazy and vague will become clear and meaningful. The student will find that the more he reads, writes, and talks about the subject, the more interested he will become in it. Interest

grows with ideas and attitudes, and especially in proportion to the degree to which these ideas are clear and well organized.

Strong abiding interests are not developed in a day. In order to insure that mature individuals will be interested in classical music, art, and good literature, it is essential that they experience those things repeatedly from infancy. It is necessary, however, that the effect be satisfying. An adult's interest in geology, perhaps, dates back to the time that the teacher told a story, or exhibited a fossil. Around this little fossil the lesson was closely knit and associated. Day by day this continued until the interest spread to other rocks and formations.

Questions and Problems

1. What is attention?
2. What is the function of attention?
3. What are the three classes of attention? Define and illustrate each of the classes.
4. What class of attentive process is most conducive to learning?
5. What subjective and what objective factors condition attention?
6. How may the attention of the child be best secured in the classroom?
7. What is meant by concentration of attention? What suggestions would you give to a child who complains of being unable to concentrate?
8. Define an interest.
9. Distinguish between native and acquired interests of children.
10. How are interests acquired?
11. Suppose a pupil is not interested in arithmetic. What measures may the teacher take in order to develop the child's interest in this activity?
12. An interest is a source of effort. Explain fully.
13. Should a teacher expect her pupils to develop interests in a day? Why or why not?
14. Which precedes the other, attention or interest? Explain your answer.

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CHAPTER XIV

FEELING AND EMOTION

EVERY conscious state has its feeling aspect which gives it color and life. Without the affective processes — feelings, emotions, attitudes, and sentiments — life would be reduced to a continuous prosaic routine. With satisfaction, enthusiasm, and purpose, tasks may be accomplished with ease, efficiency, and joy. Without the elements of success, interest, and purpose work becomes mere drudgery.

It is imperative that parents and teachers begin early to build into the personality of the child the feelings, attitudes, and sentiments that are worth while both to the individual and to society. This major problem involves two phases: (1) the development of socially approved feelings and hygienic attitudes; and (2) "hitching them up" with conduct so effectively that they will function persistently.

Meaning of Feeling. A feeling is a simple pleasurable or annoying aspect of any mental process or body condition. In human life, except in the case of the low-grade feeble-minded, the feelings become quite complicated with many other influences. Experience complicates enormously the satisfying-annoying experiences peculiar to early childhood or primitive life.

Feelings may become greatly complex in the sense that they involve sensations and ideas in addition to the simple agreeable (satisfying) and disagreeable (annoying) elements. The terms simple feeling, affection, and feeling tone refer specifically, however, to that part of the process which is represented in its pleasantness and unpleasantness.

Classification of Feelings. It is difficult to classify feelings for reasons too obvious to require discussion.¹ One classification recognizes a distinction between the sensuous and ideational or intellectual feelings. While these two classes overlap, the intellectual feelings are considered as higher feelings and the sensuous as lower. The intellectual feelings involve memory and imagination elements. The satisfyingness that comes from success and the annoyance attending failure are forms of this complex feeling. The consciousness of a good deed is an intellectual feeling, but the pleasure attached to the eating of a good dinner belongs to the sensory level.

What is perhaps a better classification is the recognition of complex feelings of the following levels: (1) sensory; (2) intellectual; (3) social and moral; (4) aesthetic; and (5) religious. Attitudes and feelings due primarily to experience and involving memory and imagination elements belong to the second class. Attitudes of surprise, astonishment, and interrogation, and the feeling of satisfaction that comes from historical and scientific endeavor are of this kind. Feelings accompanying gregarious, sexual, parental, patriotic, and ethical impulses and desires belong to the third class. Feelings and attitudes of appreciation pertaining to the beautiful in art, sculpture, architecture, poetry, music, drama, and interpretative dancing belong to the fourth class. Just as conscience is an illustration of the third type, attitudes of reverence and worship are examples of the fifth type. The religious feelings and sentiments center primarily around man's attempt to adjust himself to God.

Theories of Feelings.² While we have many views of feeling there are two major theories current that embody the chief elements in all the theories. One maintains that feelings of

¹ Simple feelings are either pleasant or unpleasant. The classification given here is of complex feelings which include sensory, ideational, and volitional elements in addition to the affective elements.

² It is now generally believed by physiologists, neurologists, and physiological psychologists that simple affective experience (feeling or affection) is largely, if not wholly, thalamic rather than cortical.

pleasantness and unpleasantness are due to the readiness or unpreparedness of neurone patterns to function. Pleasantness results from the activity of neurones when they are in one kind of condition, and unpleasantness results when the bodily condition or setting is the opposite. All degrees of feeling tone exist between the extremes of pleasantness and unpleasantness and are represented physiologically by bodily states and conditions somewhere between those that correspond to pleasantness and unpleasantness. Since nothing is known about the inner condition of the neurones, this theory is not proved.

A slightly different theory regards feelings as blends of organic sensations. Pleasantness and unpleasantness thus result from different organic reactions to some stimulus. The blend or complex of sensations aroused by a cycle of stimuli and responses is the emotion. Pleasantness and unpleasantness are blends of sensation qualities. Although this theory is quite popular, there are certain difficulties with the hypothesis since it assumes two mutually exclusive types of organic changes which go with the two feelings. Since our knowledge of inner responses is so limited, we have no proof as yet for this theory.

Emotion Defined. When the bodily response is particularly of a visceral and glandular nature, and both widespread and profound, the resulting chains or complexes of feelings and sensations are called an *emotion*. Emotions are blends of instinctive, sensorial, and ideational elements. They are temporal in the sense they may be of short duration or persist for a long time. As a rule, they are suddenly initiated. They are insistently organic. Changes in bodily functions, such as respiration, digestion, peristalsis, pulse rate, and blood pressure correlate with the emotions. The perception or awareness of the exciting cause and the bodily changes that attend this process involve both the activity of the cerebrospinal and autonomic nervous systems. Through the action of the autonomic system, the glands of internal secretion are activated or inhibited. The feeling attending the experience is usually

strong. It is also generally recognized that every emotion has its instinctive side, and every instinct its emotional side. Furthermore, it is clearly obvious that the "higher emotions," made possible through education, involve the great association areas of the brain.

Behavioristic Studies of the Emotions.¹ The complex nature of adult emotional responses lead the experimental psychologists to study the emotional reactions of children. Most children at three years of age have acquired many kinds of actually harmful reactions that are generally regarded as being emotional in character. They exhibit fear² in many situations, anger and rage in many others. These reactions raise the questions — Are emotional reactions hereditary? Is there an hereditary pattern for each and every emotion, e.g. fear, rage, love, reverence, admiration, shame, shyness, humor, jealousy, and awe? Or, are these just words to describe general ways of behaving without implying anything as to their origin? The problem can be solved only by studying very young children in the nursery, or studying young children who are constantly under the observation of the experimenters. The behavior studies made indicate that when fear reactions do occur they are conditioned, or learned, except when they are made in response to loud noises or to the withdrawal of support from under the body, in which case they are unlearned. Rage³ is a form of unlearned emotional response which can be induced by hampering the bodily movements of the child. The love response⁴ in young children may be elicited by stroking the skin, patting, rocking, and tickling.

There is no absolute certainty that there are only three types of unlearned emotional responses. The emotional responses of

¹ Watson, *Behaviorism*, Chaps. VII-VIII.

² This response is sometimes spoken of as *startle* and *withdrawal*.

³ This response is called *resistance* by Hollingworth and *struggle* and *rejection* by Allport.

⁴ This term is better designated as *content* by Hollingworth, and as *sensitive-zone responses* by Allport.

the baby are quite simple, and the kinds of stimuli which call them out are few in number. Thus fear, rage, and love responses are thought to be the roots or nucleus from which all subsequent and more complex emotional reactions develop. Owing to the fact that emotions are so easily conditioned, many complex emotions are commonly but erroneously regarded as unlearned. The conditional origin of fear responses, excepting as noted above, has been established.

Assuming the validity of the experimental studies, it should be emphasized that a great responsibility rests upon parents and teachers to condition or recondition children, as the case may be, for the good of the child and society. The ordinary emotional behavior of the child is a mirror in which the parent or teacher may see himself. True, the emotional action patterns may be hereditary in part, but its many forms and blends are primarily the result of environmental factors operating both before and after birth. The following important factors operate in determining the strength and the nature of the emotion developed in the child: nutrition, internal secretions, general bodily health, disease, physical defects, and a nervous, irritable, nagging, faultfinding tendency on the part of the parent or teacher. The infliction of corporal punishment is still another factor that augments a bad disposition. A neurotic teacher or parent is quite likely to be given to fits of passion or anger before the child. If sweet-tempered children are to be produced, they must be spared the riotous emotional explosions of parents and teachers. They must be treated as human beings, possessed of impulses and desires that need to be wisely and kindly stimulated, encouraged, and guided. The parent and teacher must be a confidant and friend, not an enemy.

Emotions As a Drive. Emotion is one of the great dynamics of human activity. "It is the engine that drives the airplane of life. Without it life would be a dull and drab existence, an appalling Egyptian bondage. Without it creative activity would be impossible; art, music, literature, and drama would

linguish and die. It is only when the emotions are properly stirred that humanity moves forward. Then, men grow unselfish and fling their lives into great causes.”¹ As Jastrow says, “Emotion applies the spur to the mental gait; it is an obstruction-meeting device reserved, not for the run, but for the jump in the hurdle race of life.”² Professor Leighton writes: “Intelligence will not function unless the emotions are enkindled. The emotions will not be enkindled unless the imagination be fired. The imagination cannot be fired, for the ordinary run of human beings, except through history, poetry, art, and worship. Let the youth be fed on the examples of the great cultural and spiritual heroes of the race. Let poetry, music, painting, and the drama be enlisted to body forth in concrete symbols the religion of humanity.”³

Great orators know the value of emotions as a driving force. When Mark Antony in Shakespeare’s *Julius Caesar* faces the frenzied mob hostile to him, he succeeds in winning them from adherents of Brutus and Cassius to the cause of the murdered Caesar by using the power of suggestion skilfully masked, and the use of the concrete. He innocently says, “let me not stir you up to such a flood of mutiny and rage,” when that is exactly what he wishes to do, and he shows them the toga of Caesar containing the dagger thrusts of Brutus and Cassius and then, as a final drive to action, the dead body of Caesar.

There would be no possibility of the growth and progress for the individual if each emotional experience left him in the same state of mind. A new and strange emotional experience may dam up habits and lines of conduct. The individual under the duress of internal emotional situations may literally “be born again.” Responsibility, loss, or defeat may cause the individual to draw on and use hitherto unknown reserves of power and energy. The human individual lives usually far within his

¹ Evans, Edwin Barlow, *The Place of Emotions in Education*. An unpublished paper.

² Jastrow, *Character and Temperament*, p. 109.

³ Leighton, *The Individual and the Social Order*, p. 509.

limits. He possesses abilities of various kinds which he habitually fails to use. He works below his maximum and he behaves below his optimum. To what do the more efficient individuals owe their greater achievement? The answer is simple. Either some unusual situation fills them with emotional excitement, or some unusual idea or purpose arouses them to make an extraordinary effort.

Positive constructive feelings assist health, produce happiness, and bring success. To be starved emotionally is a tragedy. The individual lacking in enthusiasm, generosity, altruism, kindness, and sympathy is poorly equipped to meet "the slings and arrows of outrageous fortune."

The problem for the teacher is to arouse by art, music, literature, travel, religion, etc., the feelings and emotions that will impel the individual onward to fullest and richest experience and productive activities.

There are several theories regarding the nature and function of the emotions. They are not all antithetical or mutually exclusive. Some of them are modifications and qualifications of others. The most famous is the James-Lange theory which takes its origin from the intimate relation between the emotions and bodily reactions. James says, "My theory is that the bodily changes follow directly the perception of the exciting fact and that our feeling of the same changes as they occur, is the emotion . . . We feel sorry because we cry, angry because we strike, afraid because we tremble, and not that we cry, strike, or tremble because we are sorry, angry, or fearful as the case may be."¹

G. W. Crile, an American surgeon, and Walter B. Cannon, the noted Harvard physiologist, have promulgated an *emergency theory of the emotions*. The sympathetic nervous system is a complicated mechanism developed to aid man in the fierce struggle for existence. The inhibition of digestion, the acceleration of heart beat, the increase in respiration, work in

¹ James, *Psychology* (Briefer Course), p. 375.

harmony and come to the rescue when the individual or the animal is in danger. They act as a check and drive. The emotion literally clears the body for action.

Watson defines an emotion as "an hereditary pattern-reaction involving profound changes of the bodily mechanism as a whole, but particularly of the visceral and glandular systems."¹ He locates the field of emotion within the individual, while in instinct the field of activity consists in making adjustments to the environment.

Crile makes emotion among civilized people a phylogenetic affair. "When our progenitors came in contact with any exciting element in their environment, action ensued then and there. There was much action — little restraint or emotion. Civilized man is really in autocaptivity. He is subject to innumerable stimulations, but custom and convention frequently prevent physical action. When these stimulations are sufficiently strong but no action ensues, the reaction constitutes an emotion. A phylogenetic fight is anger; a phylogenetic flight is fear, a phylogenetic copulation is sexual love."²

Bodily Expression in Emotion. For more than a hundred thousand years men, under the stress of flight or struggle, have put forth extreme and violent exertion. These almost death struggles have set the teeth, made the heart beat violently, the chest to heave, have brought the blood into the dilated nostrils, and have made the muscles of the face register violent contortions which observers now interpret as concomitants of terror, rage, or agony. In this way the race has stored up vast complexes of bodily reactions. The actor avails himself of these race heritages by imitating these physical expressions that are the results of strong emotions. One famous actor, called upon in a certain rôle and at a definite cue to go on the stage in a towering rage or white heat of emotion, engaged a pugilist to

¹ Watson, J. B., "A Schematic Outline of the Emotions." *Psychological Review*, Vol. XXVI, May, 1919.

² Crile, *The Origin and Nature of the Emotions*, p. 76.

fight with him behind the stage in order to help him to work himself up to the desired condition so that, when he stepped on the stage into the scene, his face would be flushed, his heart beating vigorously, his nostrils dilated, and his whole person revealing the stress of a violent emotion.

Extensive laboratory tests, especially those of Crile and Cannon, show that the following definite changes take place in the body when an animal is strongly driven by emotion: (1) the marshalling of an energy-giving substance in the brain cell; (2) the augmented output of adrenalin, thyroid secretion, and glycogen, and the acceleration of oxidation in the muscles; (3) increase of circulation and breathing; (4) rise of the temperature of the body; and (5) changes in metabolism. These are preparing the animal or man for increased power of physical action. At the same time a kind of law of compensation is at work. The functions of organs and tissue that under normal conditions consume energy are inhibited or stopped entirely. For instance, gastric and pancreatic secretions are inhibited, peristaltic action ceases temporarily. This is the reason that soldiers can fight for hours without eating, that orators and actors prefer to fast before a trying speech or dramatic presentation. This accounts for the fact that Colonel Lindbergh during his thirty-four hour ordeal in flying from New York to Paris ate only half of a sandwich. Nature ruled out every function not needed in one massed focal effort.

Glands and the Emotions. Emotions bring about changes in the entire body, such as tense breathing, palpitations of the heart, flushing and paling of the face, a sickening sinking feeling in the stomach, twitchings and quiverings of the muscles. Cannon, Crile, and other investigators have demonstrated that the emotions have a marked effect on the glands, calling forth secretions from some glands and inhibiting secretions in others. This is especially noticeable in the case of the thyroid glands where increased secretion produces greater susceptibility to emotions, especially anger, laughter, or hate. Adrenalin, the ac-

tive principle of these glands, is a very powerful drug and a very weak solution will easily affect smooth muscle tissues.

Temperament. A temperament is a general name for a set of attitudes that influence behavior. Temperament is a more or less permanent or lifelong emotional state. A mood is a more or less transitory emotional condition. The classical divisions of temperament were the sanguine, melancholic, choleric, and phlegmatic. While there can be no exact arbitrary pigeonhole classification, yet these divisions are valuable to the student of human nature. No individual is wholly choleric or entirely phlegmatic. One blends in varying degrees of intensity into another. Yet every classroom contains students who in the main exemplify these types. The stimuli and appeals used on the phlegmatic student may be lost on the sanguine. Today psychologists are inclined to the view that traits of character are distributed according to the curve of normal distribution, i.e. the majority of people are cheerful, a few extremely cheerful, and a few extremely sad.

Controlled, focalized emotion produces the artist, the statesman, the philosopher, and the scientist. The artist sees life in terms of beauty, the scientist in terms of causation, the moralist in terms of goodness, and the philosopher in terms of reason.

Control of the Emotions. All normal human beings experience more or less at some time or other many different emotions such as joy, sorrow, anger, grief, fear, hate, jealousy, sympathy, disgust, wonder, subjection, elation, awe, admiration, gratitude, reverence, and so on. As a rule, the younger and more inexperienced the individual, the more violent and uncontrolled will the emotion be. The same observation holds true for the feeble-minded. The emotions of a child, while more intense, are of shorter duration than the adult's. The feeble-minded experience on the lower levels (instinctive) much the same emotions as do normal people. They experience the higher and more complex emotions only to a slight degree. Awe and reverence are probably never experienced at all. The

lower-grade feeble-minded do not fear germs or disease because they have not enough intelligence to understand them.

Emotions should be modified and conditioned but probably never violently or roughly repressed. Years ago James stressed the fact that there can be no impression without expression. To repress means to thwart, to dam up nervous currents that must have an outlet. Excessive repression may lead to serious mental and nervous disorders. Wise guidance should direct the emotions into constructive actualities. "This do" should take the place of "don't." The Ten Commandments are negative and prohibitive. The greatest Teacher rarely used a "don't." His rules for living were couched in such terms, as, do, look, seek, go, and act. The parent and teacher need to assist as fully and economically as possible in helping children develop emotional outcomes on the intellectual and spiritual levels.

The control of the emotions comes with age and practice. While the emotions of children are intense they are short-lived. Intellectual states will help to change and sublimate emotions. What the teacher aims at is self-control on the part of the pupil. Self-control is largely a control of the emotions. Just how an individual will react toward the stimulus (sensation, image, memory, etc.), is determined largely by his past experiences, habits, knowledges, and interests, and his present state of mind. By controlling these factors, one can control his emotions in a large measure.

The laws of learning — exercise and effect — apply equally well here as elsewhere in bringing about the desired changes. We have experimental evidence that emotions in both normal and subnormal individuals can be modified. The child needs to control himself by doing it. If he has been conditioned so that he gives way readily to fits of rage or passion, his reconditioning, by building up the proper controls, may require a very long time. He learns to do by doing it every day in every way. There is no royal road. Probably no better advice has

been given than that by James on the subject of acting on our emotions. He says:

"Every time a fine glow of feeling evaporates without bearing practical fruit it is worse than a chance lost; it works so as positively to hinder future emotions from taking the normal path of discharge. There is no more contemptible type of human character than that of the nerveless sentimentalist and dreamer, who spends his life in a weltering sea of sensibility and emotion, but who never does a manly concrete deed . . . The habit of excessive novel-reading and theater-going will produce true monsters in this line. The weeping of a Russian lady over the fictitious personages in the play while her coachman is freezing to death on his seat outside, is the sort of thing that everywhere happens on a less glaring scale. Even the habit of excessive indulgence in music, for those who are neither performers themselves nor musically gifted enough to take it in a purely intellectual way, has probably a relaxing effect upon the character. One becomes filled with emotions which habitually pass without prompting to any deed, and so the inertly sentimental condition is kept up. The remedy would be never to suffer one's self to have an emotion at a concert, without expressing it afterward in some active way. Let the expression be the least thing in the world — speaking genially to one's aunt, or giving up one's seat in a horse-car, if nothing more heroic offers — but let it not fail to take place."¹

One may by the law of effect learn not to give way to emotions when he finds out that much is lost thereby and nothing gained. The law of effect was used by the school principal in dealing with the boy in the following situation. The boy was severely reprimanded and called a "dummy" by his teacher when he failed to respond properly in class. The pupil said something back for which he was sent to the principal's office. The principal with singular keenness of insight into human nature, released the tension of the boy and changed him for the

¹ James, *Psychology*, Vol. I, pp. 125-126.

better by the simple remark, "Fred, as you grow older you will learn that no matter what a lady says, a gentleman never answers back." The law of effect is also used by the mother of a three-year-old who has developed the habit of lying on the floor and kicking with rage, when she lifts the child to a narrow mantelpiece. Fearing a tumble, the child stops his raging. After a few such experiences he learns to inhibit the tendencies to kick, stamp, and cry.

In the lower grades the child cares most for the approval of parents and teacher. Gradually he should be interested in gaining the approval of his group and still later in gaining the approval of his own conscience, which has been developing all the while.

The appeal to a child of kindergarten age to do his work well, and to tell the truth, will be of little avail unless the child can be made to see that it pays to act that way in terms of the living present and that it is satisfying right then. The teacher needs to meet the child fearlessly on the age, grade, or mentality level regardless of where that may be and then raise him to even higher and higher levels. The desirable feeling and emotional responses must be exercised and rewarded with pleasure. Getting the child to feel right toward a course of action is the first step in getting him to act toward it habitually. Children need to be taught to assume attitudes of cheerfulness, open-mindedness, and toleration, and to laugh often, and walk uprightly. The bodily posture can be made to assist in securing the desired attitude. External conditions such as light, heat, and ventilation also affect one's attitudes and feelings.

Emotions are contagious. Through imitation one assumes the attitude of those about him. If the teacher is good-natured, kindly, and jovial, the effect on the pupils is most wholesome. If she is irritable, faultfinding, or "cross," it is immediately reflected in the discipline and attitude of the school.

Occasionally a few good thinkers are discouraged by rapid-fire questioning, drills, and examinations. These children seem

to think and feel so intensely that rebuke or excitement interferes with their mental processes. They need a bit of humor, calmness, and a chance to relax. A calm but sympathetic attitude on the part of the teacher, or a fitting word aptly spoken will often relieve the tension. Other children are unable to follow the teacher if she introduces marginal issues, supporting evidences, or comparative references with broader-minded and more experienced children would follow easily.

Some children have a heightened sense of self. The world revolves around them. They worry and fret over this and that. Their self-consciousness interferes with many of their mental activities. The teacher's task is clearly one of getting them to think of other persons and things and lastly or never of self.

Fear and Its Control. Fear influences the entire body. Each bodily organ or tissue is stimulated or inhibited, depending upon its use or hindrance in securing a suitable biological adjustment. By the concentration of neural impulses and glandular secretions, more energy is released and greater power is developed. Under the urge of fear, one is frequently able to perform almost impossible tasks. The lavish use of all of the forces involved during the emergency leaves the individual in an exhausted state following the fear experience. It is highly desirable, therefore, that man control himself wisely and thus avoid the after effects.

When fear makes its appearance, it may be dealt with in one or more of three ways. The force of example on the part of parents and teacher is tremendous in the inhibition of fear tendencies in children. This method is always effective. By associating some original satisfier with the stimulus that arouses fear, the fear response can be lessened. Appeal to the child's knowledge and reason may also be used to inhibit a fear response. The value of the method depends upon the mentality, experience, and age of the child. Fear has its value. In a modified form it contributes to the perpetuation and stabiliza-

tion of society. It is important for society, however, that the fear be well founded. Too frequently it has no basis except in the imagination.

Punishment. At an early age the child learns to associate fear with physical pain. The parent or teacher who uses corporal punishments is well aware of this fact. Some educators advocate its use, others deny that it has any value. What has science to say on the question? Certainly the whipping or beating of children is not a scientific method. The parent and teacher should be interested in building up ways of acting in the children that square with group behavior. The child behaves as he does because of the influences of heredity, environment, training, and will. It is primarily the fault of parents, teachers, and others that he behaves as he does. If one would like to have him behave differently, one must change him by untraining and then retraining him. The social training of every child should begin in infancy and continue throughout life. Whipping and beating are poor methods to use because the offending act often occurs a long time before punishment follows. Consequently, the young child often fails to associate the offense and the punishment. Whipping is most frequently resorted to as it affords an outlet for the sadistic emotional impulses of the parent or teacher. If the whipping *must* take place it should follow immediately after the deviating act has been committed. Even in such event, it cannot be scientifically regulated. It is either too severe, or too mild, or the deviating act does not occur frequently enough with attendant punishment to set up the desired responses, or it is repeated so frequently (as is often the case) that all effect is lost. How, then, are the desired negative responses to be developed? If at all, the punishment should be administered in a thoroughly objective way the moment the child is caught in the mischievous act. Natural punishments are probably the most effective of any.

Writers on the subject have repeatedly pointed out that the parent or teacher becomes involved in the situation when pun-

ishment is administered. Consequently, the child grows up to hate the person who has most often used the rod.

Anger. Anger may be controlled by paying attention to or introspecting the emotion itself, by delaying the action until one has "thought it over," or by exercising vigorously for a while. Moreover, by reflecting on how foolishly others behave when angry, or trying to see ourselves as others see us, we are sure to check our anger. "A soft answer turneth away wrath," is psychologically as true today as in the past, especially in situations where anger and prejudice exist. Through education, man learns to control his emotions, thoughts, and actions, with the aid of society, especially through such agencies and institutions as customs, traditions, law, government, education, art, and public opinion.

It has been pointed out elsewhere that the teacher can control pupils on the level of feeling much easier than on the level of reason. The teacher who wishes to be liked by her pupils and who would control them successfully on this level must cultivate a genuine sympathy with her pupils. If she merely assumes it, or if she has no real interest in the pupils, they will soon find it out. The teacher may fool herself. "She may fool some of the children all of the time and all of the children some of the time, but she cannot fool all of the children all of the time." The teacher can cultivate this sympathy by understanding child nature and the environment in which they are being reared. She must find out how their minds operate, how they think and feel, and what their hopes and ambitions are. If the child is delinquent in class work or conduct, the teacher must try to find the cause. The teacher must be kind, firm, consistent, and dependable; she must not be an "easy mark" for the pupils who would bluff their way through. The "easy" teacher is always criticized if not actually despised. The teacher must be a model, not a chum. She must be democratic, but dignified. She must have poise and command respect.

All other things being equal the individual with balanced,

controlled emotions has the best mental health. Crile maintains that fear lays its tribute and toll on every organ and tissue. Man fears with his entire body. While fear enables the individual like the animal to perform superhuman feats of strength it is extremely exhausting. One pays for it the next day. Fear is wasteful and should be "indulged" in only under unusual circumstances.

If one wishes to be healthy and happy he should keep his emotions under control. In the long run the individuals who can control the destructive emotions of rage, hate, envy, jealousy, and fear have the better mental health. Augustus Thomas, in his drama, uses this psychological principle with great effect with the thesis that hating destroys the hater.

The Freudians maintain that abnormal mental life means that the emotions are not functioning properly. Fixations, complexes, and conflicts keep the individual from maintaining a normal emotional life. The problem is to secure adequacy of response. An emotionally balanced person achieves this balance by facing the facts whatever their nature. It is man's inability or unwillingness to face facts that causes many emotional disturbances in human life. Mental health depends on facing reality, while various mental and nervous disorders are attempts to escape from it.

Effect of Feelings and Emotions on Learning. The emotional element plays a rôle second to none in the stimulation, elimination, and redirection of the native tendencies. While the individual's emotional responses are primarily conditioned (acquired), he does not learn how to be afraid. The feelings, emotions, or urges in any and every individual are fundamentally inborn or native, but subject to modification. The creative mind in art, science, and literature depends upon emotional susceptibility no less than upon imagination. It is also probable that educational, social-moral, eugenic, political, and religious reforms could never be effected by anyone lacking an emotional capacity.

Learning may be facilitated if: (1) the individual practices with satisfaction; and (2) if success attends his efforts. A proper mind-set or feeling attitude toward the task insures proper attention to the task in hand. It is also instrumental in securing practice, and in fixing the outcomes of learning. Satisfaction accompanies experiences of which one wishes more or which one seeks. From the point of view of securing effective practice, conditions must be controlled so the practice will be pleasurable. "A knowledge of the goal to be reached, a knowledge of the purpose of the activity, of success attending the effort expended, and a whole-hearted desire to learn will make the practice more pleasurable and consequently tend to strengthen the action patterns involved in the learning process. The pleasurableness of the learning has an additional value. It is highly correlated with the well-being of the body and with glandular secretions, nutrition, or digestion, and neural activity, all of which facilitate the necessary conditions for learning. Annoyance or unpleasantness is negative, in the sense that it inhibits or retards mental processes."¹ Intense emotions, whether pleasurable or annoying, must also be avoided as they, too, inhibit learning.

Experimental evidence shows that the student's like or dislike for a subject affects his record very materially. Poor work and bad attitude are interacting factors. Each influences the other for the worse. A good start with zeal and determination and a knowledge that one is continually making progress gives rise to a favorable attitude, which in turn facilitates the learning. Here is an example of the Biblical law that, "to him that hath, shall be given, and from him that hath not shall be taken even that which he hath."

There is still further experimental evidence which shows that students are better able to recall what they have learned if they know they will be held responsible for the tasks assigned. The moral is too obvious to need further elaboration.

¹ BENSON *et al.*, *Psychology for Teachers*, pp. 103-104.

In general it may be said that every effort possible should be made by parent and teacher to put the child into perfect rapport with the school, and to induce a favorable attitude toward the teacher, toward the school subjects, and toward specific tasks. In other words, one of the teacher's greatest problems and duties is to secure a favorable attitude on the part of those being taught. It is an axiomatic principle that the teacher can secure the good will and coöperation of pupils (and also of their parents) on the level of feeling, much more effectively than she can on the level of reasoning.

The teacher must recognize that, in addition to having an aim and making improvement, the child must have a desire or "will" to learn. This can be secured generally by focusing attention on the improvement. The teacher can do this best by setting up standards which the child can reach after some expenditure of effort, and by requiring him to keep a daily or weekly record or graph of his results (in the more formal subjects). There is no tonic quite so effective for learning as that of meeting with success. It is very important that every teacher set up situations so that every pupil will feel the thrill and enthusiasm of success.

The Teacher's Emotional Bearing. The teacher with carefully trained emotions is generally the more effective in the classroom. There is a Scylla and Charybdis to avoid. The cold, unsympathetic teacher invites mischief, evasion, and lying. On the other hand the gushing teacher who sentimentalizes over nothing calls down upon herself disgust and humor from her pupils. The teacher who strives to understand the lives of her pupils will be genuinely sympathetic.

Questions and Problems

1. Distinguish carefully between a feeling and an emotion.
2. Why is it important that parents and teachers begin early to develop in their children the proper social sentiments, attitudes, and appreciations?

3. Distinguish between a feeling and a sensation.
4. How may feelings be classified? To what extent do these classes overlap? Of what value is such a classification?
5. What theories have been proposed to explain feeling?
6. What classic behavioristic studies were made of the emotions by Watson?
7. Feelings and emotions are dynamic. Explain.
8. How may positive constructive feelings and attitudes promote health?
9. What theory of emotion was proposed by James and Lange? by Crile and Cannon?
10. In what ways are emotions expressed in terms of bodily activities?
11. What changes take place in the body of an animal when it is strongly driven by an emotion?
12. In what ways are the emotions influenced by the activity of certain endocrine glands and the autonomic nervous system?
13. Distinguish between a mood and a temperament.
14. Would a person who is in a highly emotional state be able to think clearly? Why or why not?
15. What suggestions should be given for controlling the emotions?
16. "Success is satisfying." Explain how success bringing responses facilitate learning.
17. Discuss the proposition that corporal punishment is not a scientific method of punishment.
18. What are some of the common fears experienced by sensitive or conditioned school children? How may such fears be reconditioned? What fears are native?
19. Why is it especially important that parents and teachers exemplify well-balanced emotions?
20. What is emotional instability? What hygienic treatment would you prescribe for children who are emotionally unstable?
21. How does purpose, mind-set, and attitude influence learning?
22. Summarize the chapter on feelings and emotion.

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CHAPTER XV

MENTAL HEALTH

VARIOUS terms have been used in the history of the development of health work in schools to designate the different types of activities involved. Late in the nineteenth century the subject of physiology and hygiene became quite generally required by the various states as a school subject. Since then greater emphasis has gradually been given to hygiene, mental hygiene being a phase of that subject. Failure to achieve desired results comes from an inadequate conception of the psychology underlying method and subject matter on the one hand, and on the other, an imperfect understanding of social needs. Seemingly, psychology cannot advantageously be applied to educational procedure apart from a consideration of those needs.

Authorities may differ in estimating the extent to which the subject of hygiene has actually promoted mental health. Certainly they must admit that knowledge of subject matter does not of itself guarantee the application of that knowledge. Teachers have studied hygiene, but too little effect of such study has appeared in their school procedure. Mental health is an ideal in the field of general health, to which all subject matter, method, school and class organization, and measurement should contribute. Mental health can never largely result from any specific subject in the course of study. Because of this fact the writer prefers in this chapter to place the emphasis upon the ideal rather than the subject. That boys and girls need constant guidance in mental health to the end that more perfect mental adaptation may be realized, seems obvious.

The primary function of mental-health teaching is more ade-

quate mental adaptation to environment. It is keeping the child in the best possible mental health, not in correcting defects. The latter function is secondary. The importance of both these functions deserves profound study. The body, the intellect, and the emotions form a triad and if one fails to function normally the other two are caused to suffer. Nervous breakdowns follow bad mental and emotional habits. This fact while true with reference to adults is particularly significant with the growing, expanding mind and nerves of the child.¹

Social life being what it is today, with its school work, its dancing, music lessons, training in religion, parties, moving pictures, and late hours, it seems almost impossible to give the minds and nerves sufficient rest. Frequently children at home are surrounded by a number of neurotic individuals. It is conceivable that one or more of their teachers is of the same type. When one recalls that children have inherited tendencies, that their brain centers are but in a stage of development, and that they lack adequate judgment and experience to help themselves, the reason for the nervous condition of so many is understood.

Terman² describes the nervous child as "hesitating, timid, vacillating, unable to cope with the real. More and more he falls back upon daydreams, books, imaginative enjoyments, etc. He plays little, adjusts badly to other personalities, is seldom a leader. Not infrequently he is made an outcast by his fellow pupils. Not being able to mingle on equal terms with other children or to depend on himself, he clings to adults and becomes odd and precocious . . . Absurd scruples, religiosity, over-conscientiousness may appear. The child weeps from stepping on ants, . . . suffers torment over imaginary sins, etc."

Healthy mental habits are fully as important as healthful habits of the body. For mental and emotional stability chil-

¹ Payne and Schroeder, *Health and Safety in the New Curriculum*, Chap. XXIII.

² Terman, *Hygiene of the School Child*, pp. 291-296.

dren must have sufficient rest, must be allowed mental freedom, and must avoid mental conflict. Many teachers, parents, and well-meaning friends are constantly harping at a child in order that he may be promoted in school. Certainly such artificial accomplishments are not all of life. Such prodding leads to unnecessary worry and assumes the form of negative, rather than positive training whereby the child is led to concentrate on his problems and to meet with calmness such emergencies as confront him during childhood and adolescence.

Many mothers admit that their children are very nervous, but seldom discover the actual cause. At the hands of the teacher this condition may have no occasion for improvement. "The mother who pampers fails to realize that her child will develop only as he is given opportunity to overcome difficulties, while the pessimistic, overbearing teacher must realize that optimism pays the largest dividends and that overbearing authority shatters initiative. Equally destructive from the training standpoint is the weak-willed teacher who allows the children to run wild."¹

The nervous child should be studied to determine the answer to the following questions:

1. Does the child get sufficient rest?
2. Is he being pushed beyond his normal capabilities?
3. Is the home life conducive to strong steady nerves?
4. Do parents feel that they own the child, or that they are privileged to be but guardians of his childhood?
5. Has there been a recent and adequate physical examination as to possible physical defects or improper diet?

It is not uncommon for children to show excessive emotional reactions such as fear, crying or stuttering, fretting and worry over trifles, and the like. Parents often give a history of children having night terrors, restless sleep, and attacks of indigestion. The majority are oversensitive and cry at the slightest reproof. Occasionally the twelve- or thirteen-year-old girl be-

¹ *Ibid.*, p. 302.

comes hysterical at the slightest provocation, even though her work in school is well done.

With the onset of puberty, physical and mental changes are due to an internal secretion developing in the gonadal glands. Without this secretion neither the boy nor girl develops properly. The time for the beginning of such secretion varies with race, climate, health, and environmental comforts. In warm climates it may come at eleven years, while in cold climates its appearance may normally be delayed until the fourteenth year or even later.¹

Too often boys and girls have not been informed about manifestations of physical change they are about to experience and they are mentally unprepared. The nature of the problem requires that the teaching be done at home, but too often the home is the last place in the world where such help is received. Winfield Scott Hall² has formulated two general principles to be followed in the instruction of youth.

1. The instruction that is to form the basis of habits during adolescence and subsequent years must be begun in early childhood and in pre-adolescence, and should continue during puberty.

2. The instruction must be positive and constructive: i.e. it must be such that high ideals of life will be firmly established. In other words, if nature is to score a great success in her preparation of the home-builder and family maker, this preparation must begin in early childhood, must be continued as a definite unfolding of life lessons, and must establish right habits, high ideals, and aspirations.

Some of the fundamentals that must be established are:

1. A recognition of the sacredness of life.
2. A recognition of the sacredness of motherhood.

¹ *The Child — His Nature and His Needs*, Chap. XV. A Contribution of the Children's Foundation. Valparaiso, Indiana, 1924.

² *Ibid.*, pp. 313-314.

3. A recognition of the sacredness of the family circle, and of fatherhood.

4. A recognition of the sacredness of the body as the temple of womanhood or of manhood.

5. Establishing wholesome thought-habits — modesty in our daughters, chivalry in our sons.

6. Establishing hygienic habits which will be conducive to the development of perfect physique and the maintenance of perfect health.

The fundamentals above enumerated should be established in the order in which they are written, the first two imparted during early childhood, the second two (3 and 4) during the pre-adolescent period, and the last two (5 and 6) during puberty.

Mental and Nervous Disorders. Our ambition to keep children mentally alert and free from mental disorders can be realized under controllable conditions. The function of the school is not limited to the development and improvement of habits and practices of children. Many educative agencies outside the school have to be taken into account. The function and responsibility of teachers extend beyond the school to the improvement of community habits and practices. Even if the school were doing its full duty as to the mental health of children, because of factors not controlled by the school psychopathic cases would still exist. There are many forms of mental and neural disturbances. They vary in degree from the slightest disorders found in all human beings to the most violent insanities. All of these disorders have a physical basis. We shall consider here only those with which the school is most vitally concerned.

Fears influence every organ and tissue of the body and should be avoided except perhaps under extreme situations. They arise from thoughts of pain, ridicule, humiliation, disfavor among associates, censure, failure, and death. Just as pleasurable emotions quicken the processes that are valuable to the

organism, fears tend to arrest these processes and produce undesirable mental states, such as extreme self-consciousness, neurasthenia, hysteria, and morbid introspection, often noticed in the adult, but traceable to the fears of early childhood and youth.

When fears arise, the individual should be caused to realize that his fear is simply an expression of the impulse of self-preservation, and that it is useful in protecting him from real dangers. One should never be afraid of imaginary dangers. Such fears always center in self and are avoided by thinking about things outside of self. Dr. Sidis¹ suggests that if pupils are sensitive or timid they tend to exaggerate their importance. He advises such victims to care less about what other people think of them and to devote more time to their own happiness. They should not be thinking constantly of their own health or exaggerate the importance of their own achievements. By living a hygienic life, working under proper conditions, and getting the right amount of relaxation and play, the individual will rapidly recover from his fears. Dr. Sidis also points out that the competitive element should not be allowed to excite imaginary fears. It is bad practice to try constantly to "keep up with the Joneses" or to compare one's achievements with those of others. Individual happiness is easily a matter of mutual aid and coöperation, rather than of competition.

The Gospel of Relaxation. When difficulties beset the individual, it is often possible for him to find comfort in the saying used by Lincoln when he was assailed by grief and anxiety: "And this, too, will pass." The individual should acquire habits and attitudes of confidence and patience. He needs to learn that selfish tendencies should be modified in the interests of humanity and that it is futile to worry. He should seize every possible opportunity to render a service. He should remember the common-sense injunction, "The mind can cure what the mind has caused." Habits of an unhealthy nature

¹ Sidis, *Nervous Ills*.

are fraught with unhappiness and failure. The tendency to form mental attitudes, however, has a silver lining, for it is also possible to form habits of cheerfulness, courage, and confidence. A bad mental habit is a cruel master over the body. A good mental habit is a beneficial protector and healer of the body.

The American overtension, jerkiness, breathlessness, intensity, and agony of expression are primarily social, and only secondarily physiological phenomena. They are bad habits, nothing more or less, bred of custom and example, born of the imitation of bad models and the cultivation of false personal ideals. This prevalent overtension has been ascribed by Dr. Patrick ¹ as a cause of profanity, alcoholism, and even war. He believes that such let-down and return to the primitive can be prevented if we get the proper amount of daily relaxation in some systematic way through sports and play. This is not a new doctrine. For years the Scouts, and many educational agencies, have recognized the saving value of play and games, not only for the development of morale but also as a means of wholesome relaxation.

Suggestions to the Teacher. In general, the best guarantee against disturbing mental states are health, a purpose in life, companionship, release of tension, and positive suggestion. There is need for a regimen in daily life. Someone has offered the following suggestion: "Set the alarm for an hour that gives you ample time; get up when it rings; go to your work leisurely; lose yourself in your work; relax when it is over; enjoy yourself; regard your day at its close as a complete unit to be kept on file if it has pleased you, to be forgotten if it has not; don't smirch tomorrow with today's failures."

An unhealthful mental attitude is often correlated with an emotional tension. Mental health requires a release of the tension. There are many ways of relieving such tensions. In the first place a wrought-up emotional state may be dissipated through exercise, such as walking, punching a bag, or chopping

¹ Patrick, *Psychology of Relaxation*.

wood. Another method is talking it out with an indulgent friend. Occasionally, laughing and crying are very good safety valves. Emotions are to be expressed in some suitable and harmless way rather than to be repressed, although modern civilization makes repression necessary in some instances. Play is another means of relaxation. When it affords an opportunity for self-expression and freedom from interference, its effects are hygienic and beneficial. Play activities increase the individual's self-control. Wise supervision or direction of play activities has for one of its aims helping the youth to make progressive adjustments that promote success, health, and happiness.

Suggestion, when properly used, can contribute much to poise and serenity of mind. Positive suggestions are better than negative ones. One of the best sources of positive suggestion is a refreshing, optimistic philosophy of life. People are not born mentally abnormal, unadjusted, or discontented. These qualities are acquired.

Mental Health through Training. Recent efforts aim to improve children and adults by inserting courses in mental health into the curricula of medical schools, schools of public health, teacher-training institutions, training schools for nurses, schools for social work, theological schools, and other educational institutions. A few of the more important suggestions for training follow:

1. Children need training in habits of physical and mental health including those of rest, relaxation, and the use of leisure. Dr. Folsom¹ states that more means might be found for children to assist in minor services in or about their own homes and communities, and that more real productive service might be rendered, incidentally to education, in the schools. Children are bubbling over with anxiety for useful activity and service but are given too little opportunity. Our great mistake today lies in allowing the children too little freedom for useful activity.

¹ Folsom, *Culture and Social Progress*, p. 237.

2. Children and youths should be trained to succeed. They have a feeling of personal worth. Teachers must see that every child in some way at some time achieves success. Not to succeed is to be without hope, morals, or motive, and means despondency, defeat, and nervous breakdowns.

3. Children and youths must be given a chance for self-expression. "Mental stress and strain begin when one's work is not the expression of his desires but conflicts with them." The school, church, and community organizations must encourage wholesome attitudes through providing opportunity for youths and adults to respond naturally to feelings. They must build permanent interests and provide varied and rich vicarious experiences.

4. Children and youths must be trained to direct their attention to the present, ignoring past and future, except as they are related to the present. All studying should be done with concentration. Dawdling should not be permitted.

5. Children and youths must be trained to do something effective in meeting critical situations. They must be trained to make clear-cut decisions and then abide by those decisions. Inability to meet difficulties that arise often produces intense nervousness, sleeplessness, and excitement.

6. It is also important that every child should have normal social relationships and participation in group activities. Otherwise he is likely to develop a retiring or "shut-in" personality. It is now believed by some of our psychiatrists that this tendency to withdraw oneself often leads to seeking refuge in a neurosis. A cardinal duty of teachers and social workers is to see that every child has normal social relationships in both work and play.

7. Teachers should exemplify such virtues as optimism, joyousness, poise, sincerity, loyalty, sympathy, self-control, and a sense of humor. Then they will promote through imitation and suggestion these qualities in others. An optimistic philosophy of life contributes much toward serenity and poise.

Delinquency. Mental disease is often responsible for delinquency. As with physical disease, many causes may be found. Some of these causes may be augmented by the school itself. Let us imagine a school having but one prescription to offer regardless of the wide range of needs, abilities, aptitudes, and interests plus the teacher with a frigid personality. Such a school has misfits, failures, and entirely too much retardation. Pupils on approaching adolescence have often been feeding too long on that diet which is of questionable value even for the masses. The school probably coöperates with other environmental factors in forcing certain pupils into truancy and from that to delinquency.

The most direct approach to the problem of delinquency is through educational life: (1) the origin of delinquent ideas; (2) the time or period when these ideas have their way; and (3) the essential conditions or circumstances under which they occur. Carriers of mental disease are often the unrecognized causes which attack the child at a time of low mental vitality and start him on the downhill road.

Certain specific mental-health habits and attitudes should be promoted by teachers and parents. The following list may be useful:

MENTAL HEALTH HABITS AND PRACTICES ¹

A. *Mental and Emotional Health*

The pupil

1. Has a keen, active interest in friends, games, and hobbies
2. Is curious concerning the world about him
3. Persists in his work
4. Pays attention to the task at hand
5. Keeps his project in mind until it is completed
6. Completes his task successfully, reasonably often

¹ From a list prepared by the Committee of Ten on Health Education, Jersey City, New Jersey, 1928.

7. Does his work promptly
8. Tells the truth
9. Enjoys play and work
10. Meets disappointments bravely
11. Remains good-natured under trying circumstances
12. Enjoys humorous situations
13. Forgets grudges quickly
14. Is not afraid of animals, storms, or darkness

B. *Social Relationships*

The pupil

1. Is friendly towards other children
2. Likes to make other people happy
3. Refrains from eating along the street
4. Refrains from chewing gum in public
5. Does not pick his teeth in public
6. Is courteous
7. Says, "please," "thank you," "excuse me," "good morning" "good-bye"
8. Refrains from quarreling
9. Willingly shares his possessions
10. Refrains from taking what belongs to others
11. Tries to find the owner of lost articles
12. Shows kindness towards those weaker and younger
13. Refrains from teasing and bullying
14. Shows kindness towards animals
15. Obeys the rules of the group
16. Waits for his turn
17. Willingly takes part in group activities
18. Refrains from interrupting others needlessly
19. Settles difficulties without appealing to the teacher

C. *Work Relationships*

The pupil

1. Works cheerfully
2. Keeps work materials clean

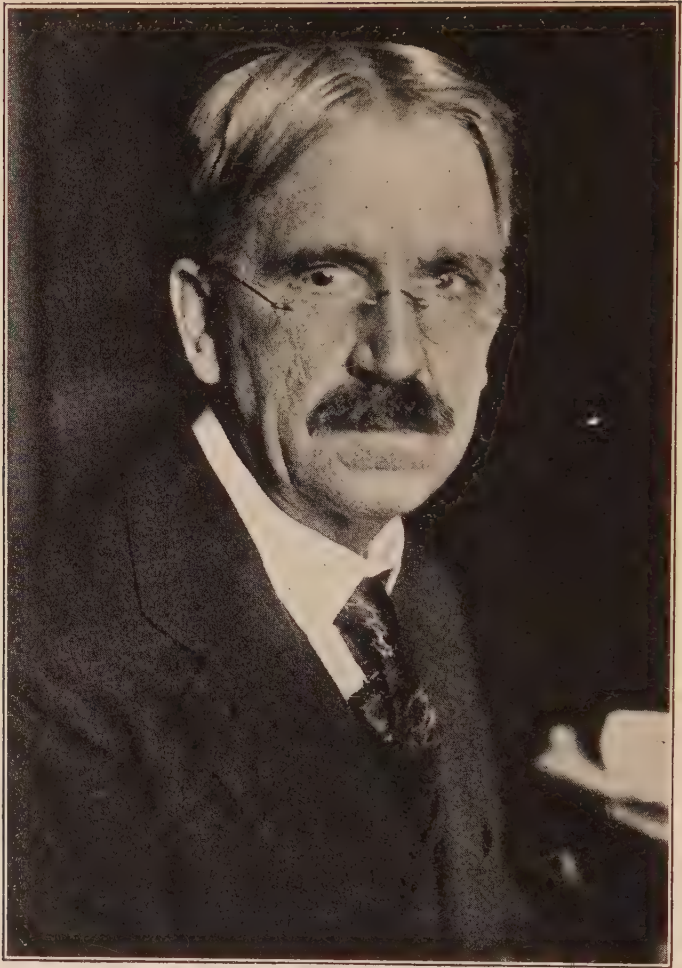
3. Keeps desk, toys, shelves, and lockers in order
4. Helps playmates, parents, and teachers in their tasks wherever suitable

Questions and Problems

1. What is meant by mental health?
2. What need is there for mental-health teaching in the home and classroom?
3. Describe the typical nervous child. What may be the causes of nervousness in a child?
4. What is the proper treatment for a child who fears that he will fail in his school work?
5. What should be done in case a child thinks that he is constantly being persecuted?
6. Discuss the unhealthy aspects of individual rivalry.
7. Discuss the proposition that school children should be taught how to relax and the futility of worry.
8. Make a list of the most frequent violations of the principles of mental health in the classroom.
9. What are the chief causes of delinquency?
10. How may delinquency be prevented?
11. Is it advisable for teachers to be constantly reminding children that they are below standard in a given subject, that they are not doing as well as they should, and that they will fail if they do not do better? Give reasons.
12. Discuss the following statements:
 - a. Teachers should be trained so thoroughly in the field of mental health that they will constantly be on the alert to detect nervous tendencies and disorders and do everything possible to prevent their further development.
 - b. The most important movement in educational psychology at this time is a recognition of the importance of habit.
 - c. The employment of mental-health measures in the classroom is of inestimably more value than the employment of mental tests, for the purpose of classifying children into relatively homogeneous groups.
 - d. Mental health has for its chief function the prevention of nervous tendencies and disorders.
 - e. Every teacher should be emotionally stable and relatively free from nervous tendencies and disorders.

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John Dewey

CHAPTER XVI

PSYCHOLOGY OF REASONING

The Stream of Consciousness. Mental life involves a stream of related experiences. James compares it with a river. It flows on and on, sometimes smoothly and at other times turbulently. This mental stream may be spoken of as a process, or as the flow of thought. Our psychic life at any moment is a cross section of this stream. Sensations, images, feelings, meanings, and strivings make up the content of this stream. The term *thinking* is used to denote trains of thought which are more or less independent of sensory stimulation at the moment. "Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends constitutes reflective thought."¹

Kinds of Thinking. Various kinds of thinking have been recognized. For practical purposes, thinking may be considered as *controlled* or *uncontrolled*. Reasoning is an example of controlled thinking, and revery is a form of uncontrolled or "free association" thinking. Rationalization is a form of thinking in which the individual arrives at conclusions that he wants to arrive at. It is a faulty form of controlled thinking rather than another kind of thinking.

Thinking may consist of trains of images and ideas suggested by one another, or it may be purposive and reflective in character. Revery, daydreaming, and "wool-gathering" are forms of the first kind of thinking. This sort of thinking has been called "free association" thinking since the individual's thoughts

¹ Dewey, *How We Think*, p. 105.

appear to flow at random and without effort. The more refined forms of thinking are called *reasoning*. All reasoning is thinking, but only purposive and reflective thinking is reasoning.

Reasoning. Reasoning is purposive thinking or problem-solving. It involves a problem situation where the final response is usually preceded by a series of related responses. The individual reacts in problem situations according to his intelligence, experience, and training in the technique of thinking.

Meaning and Thinking.¹ Objects or things to which we attend invariably point to something else which gives them their meaning. Through association, one thing calls up another thing, or rather several other things. It is these other things — deposits of previous experience — that give the percept or idea its meaning. Any one thing may have many meanings, depending upon the individual's experience and the way these experiences have been connected up with the percept or idea "thing" in mind. Meanings are derived from experience. They are learned reactions which are acquired with or without conscious intent in accordance with the laws of exercise and effect. Thus, meaning is present when the meaning-response bond has been built up through experience and when the percept or idea stimulates the bond to act. Neural connections and the stimulus determine the meaning.

Meanings make up the individual's world of experience. They are constantly changing, growing, and being tested by that experience. Actual experience of things, rather than a description of things, serves as the best stimulus for developing meanings and as the only final way of testing meanings.

In the course of history, the race has developed a wealth of experience. It is not necessary for the child to learn all of these things by personal experience, or to begin where the race began. He short-circuits the process by getting second-hand what the race got first-hand. This saves the individual a tremendous

¹ Kilpatrick, *Foundations of Method*, Chap. XVI.

amount of time, and much pain and sorrow. However, the assimilation of second-hand experiences from the race requires an adequate background of first-hand personal experiences.

Meaning is closely related to thinking. As Kilpatrick says, "Meanings are structure and thinking the function of structure."¹ Thinking involves a relating of meanings. It enables us to predict or foretell what to anticipate or expect in response to certain situations. In this sense, thinking is fundamental to deliberation and choice (will).

The Complete Act of Thought. A percept at one moment may suggest what to expect next. But percepts are not always available. The individual makes a guess as to the future. He sets up an hypothesis as to what will happen when some uncertainty exists. The guess or hypothesis is based upon his experience and his ability to see relationships between these experiences. Through the testing of his judgments he becomes able to judge better in the light of present experience.

The individual reasons when some obstacle or difficulty gets in the way. Reasoning arises from a felt need. After an analysis of the difficulty there are usually a number of mental trial-and-error responses before an accepted suggestion appears. The several suggestions are rejected until the successful one arises. The satisfactory suggestion is the one that harmonizes best with past experience and belief.

Kilpatrick,² following Dewey, gives the following steps involved in a complete act of thought:

1. "A situation arouses an impulse or tendency to pursue a certain course of action.

2. "A difficulty appears: how to continue the given course is not known; there is no appropriate way of responding known or immediately available.

3. "An examination of the situation is made to locate and define the difficulty more precisely.

¹ Kilpatrick, *Foundations of Method*, p. 224.

² *Ibid.*, pp. 242-243.

4. "Suggested solutions arise: hypotheses are formed, behavior patterns are suggested.

5. "Implications (one or more) are drawn from each suggested solution, each hypothesis.

6. "Actual trial is made to see whether the deduced implications hold.

7. "A solution is accepted in the light of the tests made."

Social Importance of Reflective Thinking. Most individuals are willing to accept the opinions and judgments of others instead of formulating their own opinions and making their own choices. There are times when the great mass of people must accept the word of experts in the field. However, leaders in education are emphasizing today more than ever before the advantage of training children in independent thinking. Dewey asserts that the future of civilization depends upon the development of the scientific habit of thinking. He writes: "To cultivate unhindered, unreflective external activity is to foster enslavement, for it leaves the person at the mercy of appetite, sense, and circumstance."¹

The Economy in Reasoning. Reasoning is of considerable importance in the solution of problems that involve consequences of considerable importance or of a dangerous character. Reasoning saves much time and energy. It enables us to solve problems on the level of ideas and imagination before trying them out in action. It enables us to economize our materials in all sorts of constructive endeavor. The engineer plans the tunnel before he starts the work of construction. The superintendent formulates his program on the level of imagination and thought before he attempts to put it into execution. Through the use of ideas and concepts, reasoning enables man to utilize a wide range of experience in the solution of a problem. Thinking enables him to apply his knowledge, techniques, and abilities to a larger scope of problems. The problem and the elements involved in its solution are not required to be present to

¹ Dewey, *How We Think*, p. 67.

sense. They are ideationally or conceptually represented, as in the case of abstract thinking. The teacher can anticipate situations and work out fairly satisfactory solutions before encountering them. Reasoning enables man to solve abstract and theoretical problems as well as concrete problems. Attending the development of reasoning techniques and practices, and the increase of experience, the individual becomes better and better able to solve a greater number and variety of problems. The great saving is owing to the fact that ideas are not limited by time and space. An individual thinks to the extent that he understands, sees relationships, and organizes his knowledge or experience. The better the reasons, the better he is able to succeed, other things equal.

Levels of Thinking. There are two levels of thinking — the perceptual and the ideational. Thinking on the level of perception involves the making of comparisons or perceiving of relationships between objects or situations present to sense. Such thinking involves perception, memory, and imagination. The ideational level of thinking involves the use of ideas and concepts and their relation to other ideas and concepts. In addition to comparison, abstractions, generalizations, and applications are used here. The more complex forms of abstract ideational thinking involve the organization of experiences.

Thinking involves judgment, inference, and proof. *Judgment* involves analysis and synthesis. It involves a consciousness of the relationship between sense perceptions, or between a sense percept and a former experience conceptually represented, or between two represented experiences. At least five relationships enter into judgment: ¹

1. The formal relationships (difference, identity, and similarity).

2. The qualitative relations of genus and species ("five-fourths is an improper fraction"); of substance and attribute. ("This is wood-pulp paper.")

¹ Benson, Lough, Skinner, and West, *Psychology for Teachers*, p. 213.

3. Quantitative relations of time and space. ("The Revolutionary War lasted eight years."); etc.

4. Relations of cause and effect. ("Secession was one of the causes of the Civil War.")

5. Purpose. ("Napoleon was banished to St. Helena to prevent his further activities against England and Germany.")

An *inference* is the conclusion reached through reasoning. It is a new idea or movement or both which is thought to harmonize with reality. Sometimes it is necessary to verify the conclusion, that is, to test it out for validity and reliability. *Proof* is the term used to denote this step.

Types of Reasoning. If one proves by reference of the statement or suggestion to the general principles, the process is *deductive*; if one proves by reference to particular experience, the process is *inductive*. These forms of reasoning have much in common. Every reasoning process involves elements of both. When the emphasis is upon movement from particular instances to general, the process is called *inductive*. When the emphasis is upon applying general rules, formulas, and principles to specific problems or instances, the process is called *deductive*. The development of all rules, formulas, and principles, is *induction*, while the application of these is *deduction*. Reasoning by disjunction and by hypothesis involve induction and deduction.

Inductive and Deductive Lessons. The inductive lesson seeks to stimulate and guide the student to observe, think, and find out for himself. It begins with concrete and particular instances and seeks to get the learner to arrive at his own rules or general conclusions. For example, the purpose in having the child understand the effects of disobedience in the case of any historical personage and in any particular experience of his own is to teach that as a rule disobedience brings regrets and troubles. The teacher purposes to get the learner to arrive at a universal truth through appealing to his own knowledge and experience.

It is important that the starting point of a lesson of this sort be found in the learner's own experience. Moreover, it is very essential that the learner understands clearly what the problem is.

Not all approaches to learning can be of the inductive or discovery type. It is frequently necessary to start with general principles, rules, or truths and apply them to concrete individual cases. Maxims and rules once understood and appreciated, are often valuable in working out new problems. The conclusions and generalizations reached from a study of certain situations may be used frequently in meeting similar situations in a different setting and at another time. For example, the child has learned from the study of a large number of concrete cases that disobedience is followed by regrets and suffering. This fact becomes to him a *master idea*, a rule or principle which has general applications. Once he has fully comprehended and accepted it, it serves as a control over his conduct. A great part of the social, moral, and religious instruction during childhood and adolescence involves the application to one's daily life of the rules and principles which have been evolved and stated. The object of the deductive lesson is to stimulate and guide the learner in applying the truth.

Reasoning Ability Develops Gradually. Much has been said about the advent of adolescence and the beginning of reasoning. Reasoning develops gradually and not suddenly. It begins in the early childhood and continues until senescence. Growth in ability to reason is conditioned by native capacity, environing opportunities, training, and conscious desire and effort to learn.

Causes of Poor Thinking. Poor thinking may result from a single cause or a combination of causes. The cause may be due to an inadequate supply of facts or data bearing on the problem at hand. It may be that the facts or data are not reliable or relevant to the problem. The individual may not know the technique of thinking: how to collect, assemble, and

organize facts, and how to check the reliability and validity of the results and conclusions. The individual, if biased or privileged, may base his conclusions, not upon the facts observed, but may read into them his own desires (rationalization). He may lack fertility in the making of guesses or in theorizing.

Training Children to Think. Training to think is very largely a matter of developing open-mindedness, acquainting the individual with the techniques involved in thinking, and providing opportunities to think. Good thinking implies an adequate supply of reliable facts or data bearing upon the problems. Moreover, children and youths must be allowed to think. They must be permitted to offer suggestions toward the solution of problems. They must be taught to judge the value of facts, to state their conclusions clearly, basing them upon the facts used. They must be taught to verify their conclusions. Finally, they should be taught as far as possible to use terms precisely.

The first step in solving a problem is to understand just what the problem is. The problem must then be kept constantly in mind. The problem may then need to be analyzed with attention focussed on one detail at a time in an orderly manner. Some individuals are easily distracted. They get off the track and offer irrelevant suggestions in a random way. Economy demands keeping the subject in mind and guiding activities in the light of the problem. As thinking proceeds from one step to another, the learner should attempt to guess the outcome. When he arrives at a solution, it is advisable to have him review the steps in the process, formulate the principle involved, and apply the generalization or principles to other situations and problems.

Students who are interested in learning how to think may gain much additional information from a study of logic and the methods used by great thinkers.

Rationalization. Rationalization is a term used to denote the mental process of selecting reasons that support our personal desires. Rationalization is partial and biased. As a rule

people rationalize about religion, politics, and the causes of war. They reason to a greater degree when it comes to business, medicine, and agriculture. Rationalization is often a subtle process. The victim is seldom aware of his bias.

Rationalization takes many forms. Occasionally an individual, failing to win success or to gain mastery in a certain situation, will not admit that defeat was due to his own deficiency. He excuses it as due to chance, "pull," or some other cause outside of self. The parents who failed to secure a physician for a sick child may lose the child. They comfort themselves with the thought, "It was the Lord's will," or "It was to be and so it was." They project the cause and thus escape blame. Occasionally we meet people who console themselves in defeat with the thought that it is a blessing in disguise, that they really don't care. The poor, for instance, may assert that money is the root of all evil. Other examples are: that Phi Beta Kappa honor students don't amount to much in life, that gifted children are nervous, that pretty girls have little intelligence, and that intelligent girls are homely.

On the other hand, we often find folks who appear perfectly satisfied no matter what the calamity. These people thank their lucky stars that they live in lowly circumstances since they are more comfortable and happy than many leaders or gifted people. Lacking a great amount of ability as leaders or learners, they find supreme happiness or contentment in the work they are doing.

There is another form of rationalization that we find everywhere. Systems of ideas are developed that can be modified only with the greatest of difficulty even when evidence is presented. Such prejudices, grudges, or beliefs are impenetrable to reason and facts. This form includes ideas of superiority of race, religion, nation, and town, and beliefs about such matters as freedom of speech, toleration, the Trinity, prohibition, etc. The work of education is to produce thinkers in the scientific sense, not merely rationalizers.

Questions and Problems

1. Criticize the assertion made by some that the age of twelve or thirteen marks the beginning of the age of "reason."
2. Outline the stages of reasoning involved in the solution of some practical problem.
3. How does perceptual reasoning differ from ideational reasoning?
4. What does organization of experience mean and what is its importance in daily life?
5. How can youth be trained to reason?
6. How may we organize our experiences in order to make them significant?
7. How would you develop open-mindedness and tolerance toward folks of another race or religion?
8. How may the teacher make real and vital problems arise in connection with classroom work?
9. How is deduction related to induction?
10. What is rationalization? Cite instances that have come to your attention.
11. How may pupils be induced to test out their hypotheses?
12. What is the social importance of reasoning?

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James E. Lough

CHAPTER XVII

EDUCATIONAL MEASUREMENTS AND THE NEW TYPE OF CLASSROOM TESTS

THE need for more objective measures of achievement has long existed. During the past thirty years great progress has been made in the development of objective classroom tests. Historically the first step in this direction may be accredited to Rice, but it remained for later investigators, notably Thorndike, Otis, Courtis, Buckingham, Monroe, and McCall, to develop and perfect fairly reliable educational tests and scales. The many studies of school marks¹ have revealed the fact that school marks as traditionally derived and assigned are variable, untrustworthy, and not essentially meaningful. No scheme has been discovered for standardizing them although many plans have been suggested.

Educators today are well aware that the traditional type of examination responses cannot be accurately evaluated. Some years ago the writer submitted a written demonstration of a theorem in plane geometry, for the purpose of evaluation, to about fifty Junior and Senior high school teachers, all of whom were familiar with the subject. A per cent mark was assigned by each teacher, and as one might expect the evaluations ranged

¹ The reader is referred to studies by Daniel Starch, F. J. Kelly, F. W. Johnson, and others on the unreliability of teachers' marks.

The discussion of the new type of tests in this chapter is from the standpoint of their potential value in objective *testing* rather than as a *teaching* device. The essay or traditional examination served the double function when it was properly devised and administered. The new type of written examination is necessarily viewed as supplementing but not supplanting the traditional examination. The authors are not unaware of danger that the new type of tests tends to stress information, and that it tests the memory of pupils rather than the ability to think logically and to express one's self clearly and coherently.

all the way from zero to one hundred, there being several minimum and several maximum marks with the mode at sixty. Had the same teachers evaluated the paper again, except as they might have remembered their earlier ratings, the chances are that very different marks would have been assigned.

Educational test results from the standpoint of accuracy are essentially of two kinds: (1) subjective, and (2) objective. Subjective results are obtained as described above and depend for their face value upon personal judgments. Purely objective results are free from the subjective element. When one measures the height of a room by guess or estimate the evaluation obtained is subjective; while if he measures the height with an established measure such as the two-foot or six-foot rule the measure is objective. Most opponents of the objective measure as used in education are either not sufficiently familiar with it through practice, or some mental bias is causing an undue influence. With the rapidly changing social conditions of the twentieth century, teachers are being required to do work of a more significant nature than to measure conventional subjects and behavior responses such as habits and attitudes, with subjective measures. We must use measures, the units of which have more significant meaning.

The instruments used in educational measurement include both tests and scales. The test may be made up of a series of questions, exercises, performances, or problems. The traditional test consisted usually of ten questions or problems which were not weighted for relative difficulty. Often but eight of the ten were to be answered. The pupil then would get the same mark on the test regardless of which eight were answered in a manner acceptable to the teacher at the time the answer paper was marked. But the teacher, being human, is a variable, and the rating assigned depended in large measure upon how the situation (written answer) appealed to him at that particular time. The rating was largely affected by a composite of chance elements. The same pupil-response would produce

a different rating if made either with another teacher or the same teacher at some other time. The new type of classroom test aims to avoid these objectionable qualities.

The functions of school tests have been held to be of three sorts: (1) motivation; (2) training in written expression; and (3) measurement. During the last few years the motivating influence of the school examination has been considered a problem for research. Pupils often realize that other factors than their knowledge of a conventional subject operate to determine their marks. Only to the extent that they have real confidence in the validity of a test, can the test have a real motivating influence. As to the value of an examination as a means of training in written expression, experiments have shown that the examination is not a means of improving written expression. On the contrary the written examination has been found to be unfavorable to improvement in written expression.¹ The most conscious aim of all has been measurement.² This aim is valid insofar as the examination can be shown to be a true and reliable means of measurement. "The use of thirty to sixty minutes of classroom time for purposes of examining as frequently, even, as once a month or oftener, can be shown to be a very profitable investment of the pupil's time in terms of the returns by way of practice, drill, and motivation, apart from the measurement aspects of examining."³

Types of Examinations. The school test or examination may appear in any one of three forms or types: (1) the traditional essay type of written examination; (2) the standardized educational test or scale; and (3) the newer objective examination. Each form has its peculiar advantages and limitations. Many partisan contests are yet to be waged over the relative merits of each; but arguments will remain barren until a clear definition of examination objectives is marked out.

¹ Ruch, *The Improvement of the Written Examination*, pp. 6-8.

² *Ibid.*, pp. 8-10.

³ *Ibid.*, p. 146.

Criteria for a Good Examination. Whatever the form of instrument for determining school achievement or for the effects of school training upon individual behavior may be used, it must possess certain characteristics and meet certain specific criteria. Briefly, the test, examination, or measure must possess: (1) validity; (2) reliability; (3) objectivity; (4) simplicity of administration and scoring; and (5) specific standards.

Validity. By validity is meant the degree to which a test or examination measures what it purports to measure. Validity means the worthwhileness of the measure; that the test elements be of prime importance; that the questions sample widely among the essentials over which the complete mastery on the part of the pupils can reasonably be expected; and that the test elements can be defended on the basis of more than mere personal opinion.

The fact must not be overlooked that any examination can at best be but partial except as all the abilities involved are measured. For example, to test pupils on ten or even twenty fundamental number combinations is by no means an adequate measure of their mastery of all the combinations. Or to rate pupils in geography on the basis of a series of ten to twenty questions is manifestly not a valid measure of their knowledge in geography except for general survey purposes; certainly not, for diagnostic purposes. Validity, then, depends upon the purpose for which the test results are to be used.

Reliability. By reliability is meant the degree to which a test or examination measures what it does measure rather than what it purports to measure. While a test may measure the trait claimed insofar as it measures anything, the measure may be very imperfect because of measuring certain samples of the trait instead of its being a complete measure. Most tests, especially those used in the classroom, are very incomplete measures because of the small number of questions. They measure only a very small part of the ability that they purport to measure. They do not cover all phases of the trait to be measured. While sampling is a practical necessity, it is often

true that a test is used to measure a great deal more than it is able to measure. It reminds us of trying to have a small hen cover fifteen eggs effectively.

A second form of the same test is often given to the same pupils after an interval of two days under similar conditions and the results are compared by determining the coefficient of correlation. A test may be said to be reliable according to the coefficient of correlation. A high correlation means that the test obtains about the same results whenever it is used provided that a uniform procedure is followed with each trial.

The causes of unreliability are: (1) subjectivity; (2) brevity; (3) coarse units; (4) nature of the trait being measured; and (5) the actual variations in pupils tested at various times.

Objectivity. Objectivity has already been mentioned in connection with its opposite, subjectivity. It is the degree to which the personal element or judgment is eliminated in the scoring of responses to examination situations. In large measure objectivity is a matter of mechanical construction of the examination whereby answers can be mechanically scored as either right or wrong.

Objectivity contributes to reliability through a reduction of the sources of variability. Perfect objectivity is attainable without much difficulty in most school subjects.

Administrative Features. The length of time required for giving and scoring the examination, the relative amount of special training required, the cost involved, and the availability of the test material are some of the special administrative features which have to be considered in the selection of a test or an examination. While an objective test requires more time for construction, usually much less time is utilized for administering and scoring. Such a test is much more discriminative and challenges the interest of pupils by virtue of the shifting of attention away from the laborious task of constructing long sentences to rather enjoyable and often pleasurable short responses. The new type of classroom test minimizes the amount

of writing required of pupils and is much more readily scored through the use of a stencil or score card. Tests may often be scored by pupils even in lower grades. The use of the objective test is most satisfactory to teachers as a time- and energy-saving device, and at the same time pupil traits and achievement are more adequately and reliably measured.

Standards. Norms and standards are not involved in the ordinary written examination. However, teachers can gradually accumulate useful norms by repeated use of the same examination. The traditional test is usually not repeated; but as tests are to be regarded primarily as measuring instruments they should be repeatedly useful for this purpose. Norms permit of comparison with other groups, schools, or classes. Ruch¹ reminds us that a pupil may be said to be measured when he has been correctly spaced along a scale of merit so that his relative achievement with respect to other members of the group has been reliably portrayed. By means of norms particular scores become standardized and can be rationally interpreted. This particular property may be left to the standardized test but is not very necessary in connection with an objective examination. We have a good examination when the margin of error in a pupil's score is reduced to as low a minimum as is consistent with practical demands of educational practice.

Objective Examination Types.² The most common types of objective arrangement of test material which have been widely used may be classified as: (1) *recall types*, consisting of (a) simple recall questions, and (b) completion exercises; and (2) *recognition types* of various kinds such as (a) multiple response, (b) true-false, (c) best answer, and (d) matching exercises. The particular form preferred may depend upon (a) the particular subject in which the test is to be used, (b) the length of examination, (c) the degree of reliability desired, and (d) the preference of the teacher.

¹ Ruch, *The Improvement of the Written Examination*, pp. 8-10.

² *Ibid.*, Chap. IV.

While it is perfectly permissible to employ various types of questions in the same test, a carefully devised set of questions is likely to consist of but one type. As a guide in the construction of tests, sample questions in various subjects are submitted.

SIMPLE RECALL QUESTIONS

English Literature

1. "Snowbound" was written by.....
2. Whitman's "O Captain, My Captain"
commemorates
3. The number of lines in a sonnet is
4. *Pilgrim's Progress* is a type of
writing known as an.....
5. George Eliot's real name was.....

American History

1. The first president of the U. S. was.....
2. Lexington is situated between Cambridge
and
3. The Maine was sunk in what harbor?.....
4. Who invented the cotton gin?.....
5. In what year did the American Revolution
begin?

COMPLETION EXERCISES

Health Education

Write one word in each space so that the statement will be correct.

1. Infant mortality is.....in congested districts.
2. Candy should be eaten only as.....

3. The.....test determines immunity against diphtheria.
4. William C. Gorgas conquered yellow.....in the Panama Canal zone.
5.is called the father of modern health practices.

MULTIPLE RESPONSES: 4 CHOICES

Geography

Draw a line under the word which is the right answer.

1. Buenos Aires is a city of Spain, Brazil, Portugal, Argentina.
2. The Mongolian is Chinese, Indian, Negro, Italian.
3. Ensilage is a term used in fishing, athletics, farming, hunting.
4. The U. S. Naval Academy is at West Point, Annapolis, New Haven, Ithaca.
5. The Merino is a kind of horse, sheep, goat, cow.

TRUE-FALSE

American History

If you think the statement is true, draw a line under the word true; if you think it is false, draw a line under the word false.

- | | | |
|--|------|-------|
| 1. Magellan was the first man to circumnavigate the globe. | true | false |
| 2. Pinchot headed the food-conservation program during the World War. | true | false |
| 3. The Dred Scott decision was with reference to the purchase of Alaska. | true | false |
| 4. The French were first to explore the Great Lakes region. | true | false |
| 5. Lincoln's first purpose in entering the Civil War was to free the slaves. | true | false |

BEST ANSWER

Accident Prevention

Make a cross before the best answer.

1. Trolley cars are safest because
 - (a) they are very strong and heavy
 - (b) they interfere with traffic
 - (c) automobiles should not pass them
2. One-way streets avoid traffic confusion because
 - (a) most people are right-handed
 - (b) traffic can be more easily managed
 - (c) they always extend north and south
3. Streets are sprinkled in summer
 - (a) to keep people from crossing
 - (b) to avoid dust
 - (c) to keep automobiles from skidding
4. If you saw a train approaching a broken track you should
 - (a) telephone for an ambulance
 - (b) signal the engineer to stop the train
 - (c) look for a piece of rail to fit in
5. If you are in danger of sunstroke you should
 - (a) take off your shoes
 - (b) run to the hospital
 - (c) get in the shade or wet your head

MATCHING EXERCISES ¹*U. S. History*

In the space before each event named in the second column place the number found before the man named in the first column who was connected with that event.

¹ Ruch, *Improvement of the Written Examination*, p. 72.

1. George Washington Inventor of the cotton gin
2. Harvey W. Wiley Louisiana Purchase
3. Thomas Jefferson Forest conservation
4. Robert E. Lee Developing of banking system
5. William J. Bryan Pure food laws
6. Alexander Hamilton President of the Confederacy
7. Eli Whitney First President of the U. S.
8. Robert Fulton Advocate of free silver
9. Gifford Pinchot Inventor of the steamboat
10. Jefferson Davis Commander of the Southern
armies

Scoring Test Papers. With the recall type of test, one credit is usually allowed for each correct answer or for each blank space correctly filled in. In the use of the recognition type, one credit is likewise usually allowed for each correct response except in the case of the true-false test. With this several schemes for scoring are employed: (1) rights minus wrongs in case not all the questions are answered; (2) total minus twice the wrongs where all questions are answered; and (3) number of correct responses divided by the number of questions. The scheme last mentioned is often preferred because it gives a percentage rating.

With the multiple response, if more than one word is underlined the answer is considered wrong. The same is true if both words true and false are marked, and if more than one best answer is marked.

Use of Results of Objective Examinations in Grading Pupils. If the teacher so desires, the test results can be made to fit the traditional "scale of one hundred" by having twenty, twenty-five, forty, fifty, or even one hundred questions. If but twenty-five test elements are to be used, four credits can be allowed for each correct response. With the objective type of question it is clearly preferred to have more questions than with the traditional type. Very little time is required for adminis-

tering the test and the larger the number of questions the more complete the examination.

Theoretically test scores should all be above zero and below perfection. If there are many very high scores the test is too easy for the pupils measured. Perfect scores do not adequately measure pupils either for power or speed. On the other hand, zero scores indicate that the test is too difficult and not a measure of the pupils receiving such scores. When either of these conditions is found to obtain, the test should be adjusted accordingly. It is desirable to measure every pupil, including the very best and the very poorest, that is, to have a test adequately discriminative. Some pupil may earn a score as high as perhaps 96 while others may range downward to perhaps 21. It may not be desirable to rate the lowest pupil 21 per cent and the highest 96 per cent. "Teachers generally do, and should, feel free to make any changes indicated by the total facts at hand about the achievement of each pupil."¹ Letter grades can be assigned arbitrarily, or low pupils can be given the minimum mark. It must be remembered that the source of error arises in the examination proper and not in translating marks into a particular grading system.

Relative Merits of Various Types. Experimental studies² of the various types of objective examinations lead to the following: (1) The reliability of objective types of examinations per unit of working time is very much greater than for the traditional essay type of examination, reliabilities of 0.80 to 0.90 being possible for twenty-minute tests as compared with 0.40 to 0.70 for thirty to sixty-minute essay examinations. (2) Higher scores are earned with multiple-choice recognition examinations than with recall types. (3) The true-false form of question is definitely easier than the question and answer form.

¹ *Ibid.*, p. 103.

² Ruch, G. M., and Stoddard, G. D., "The Comparative Reliabilities of Five Types of Objective Examinations." *Journal of Educational Psychology*, Vol. XVI, pp. 89-103, 1925.

The traditional essay type of examination is not highly discriminative for various reasons: (1) there are too few questions; (2) questions are not weighted for difficulty nor is their relative difficulty known; (3) because of the subjective element teachers tend to "bunch" assigned values near particular points on the scale such as 70, 80, etc.; and (4) the measure is too coarse. These reasons comprise some of the essential and valid objections to such examinations. The central problem in measurement is to obtain "the highest possible accuracy of measurement in the time available with the greatest possible validity."¹

Tests may be variously classified according to the purpose for which they are to be used: (1) *Prognostic* tests are devised to measure special ability or disability in any given field. This type of test is useful in helping the teacher to ascertain the degree of ability the pupil has for learning music, modern languages, and mathematics. (2) *Diagnostic* tests measure difficulties or weaknesses in order that the proper remedial instruction may be given. (3) *Survey* tests consisting of samples of subject matter are used for purposes of comparing grades and schools within a particular system or for comparison of systems of schools with reference to school achievement. (4) *Individual* tests such as the Binet-Simon are for the measurement of an individual; while *group* tests may be given to forty or fifty pupils at one time. (5) *Speed* tests, such as the Burgess Reading Test are devised to measure how much work of a given difficulty can be done in a given time. (6) *Power* tests are intended to measure how difficult work of a given kind can be done. Material for such tests is arranged in order of difficulty from very easy to the more difficult. (7) *Achievement* tests which combine many of the above named qualities such as speed and power, make it possible to determine how any child or class compares with the standard or norm for that grade or age of children in general. Such knowledge helps to effect a better grouping of pupils and to adapt instruction to individual needs.

¹ Ruch, *loc. cit.* p. 103.

Present Use of Standardized Tests. Deffenbaugh¹ found that standardized educational tests are used for one or more of the following purposes in a study of 215 cities:

1. Supplementing teacher's estimates of pupil's ability
2. Comparison with other school systems
3. Diagnosis of cause of failure
4. Extra promotions
5. Determining comparative efficiency of teachers
6. Regular promotions of pupils
7. Placement of new pupils from other schools
8. Establishment of classes for subnormal children
9. Determining changes in method of presentation of lessons
10. Determining changes in subject matter of courses of study
11. Demotions
12. Diagnosis of cause of success
13. Determining class marks
14. Establishment of classes for gifted children
15. Establishment of special supervised study groups
16. Guidance in the selection of high-school course
17. Vocational guidance
18. Admission to organized school activities
19. Determining number of courses to be carried at one time by high-school pupils
20. Motivating pupils to achieve more and more

New Tests Needed. Our discussion in this chapter has been confined largely to the new type of tests for conventional school subjects. This objective technique should be applied also to the measurement of changing attitudes, ethical standards, ideals, and habits. The school has far more important functions than simply to bring about academic achievement.

¹ Deffenbaugh, W. S., "Uses of Intelligence and Achievement Tests in Cities." *Bureau of Education*, Washington, March, 1925.

Questions and Problems

1. What are prognostic, diagnostic, and educational tests? Explain the use of such tests.
2. What tests are suitable for measuring the intelligence of:
 - a. kindergarten children;
 - b. primary children;
 - c. intermediate and grammar grade children;
 - d. high-school students.
3. Justify diagnostic testing and remedial teaching.
4. Distinguish between individual and group tests.
5. What are performance tests? Name some common performance tests.
6. What is a standardized test? a scientific objective test? In what important respects do they differ?
7. What are the advantages of the new-type tests over the traditional examination?
8. Name four kinds of new-type tests that are in common use.
9. Construct short true-false, completion, and multiple-choice tests in the field of your special interest.
10. Should the traditional essay examination be discarded in favor of the new-type tests? Explain your answer.
11. How should true-false tests be scored?
12. What are the advantages and disadvantages of the new-type tests?
13. Discuss the value of a testing program.
14. Discuss the reliability of teachers' judgments, essay tests, and objective tests as a basis for promotion.
15. Of what diagnostic value are new-type tests?
16. Make a complete list of all of the factors which should be considered in the classification of school children.
17. Comment on Judd's adverse criticism of new types of examination:

"They do not give the pupil an opportunity to formulate in a coherent way a logical statement of the topics which he has been studying throughout the course. There is danger that the new types of examination will emphasize mere information and will test the memory of the pupil rather than his power of logical thinking."

Psychology of Secondary Education, p. 476.

18. How may the deficiency pointed out by Judd be overcome?

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